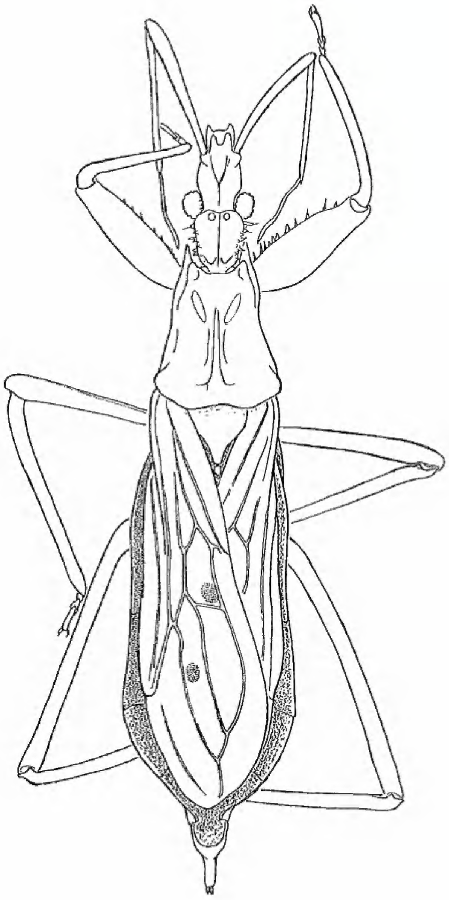
BANISTERIA

A JOURNAL DEVOTED TO THE NATURAL HISTORY OF VIRGINIA



Gnathobleda litigiosa

This rarely collected assassin bug (Heteroptera: Reduviidae) was recently found in Virginia Beach, representing the first record of the genus and species in Virginia and a northern range extension of some 500 miles, as discussed on pages 33-36 of this issue.

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Cover: *Gnathobleda litigiosa*, original illustration by Richard L. Hoffman.
Inside back cover: Sweetbay Magnolia (*Magnolia virginiana*), original illustration by John Banister.

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Additions to the Vascular Flora of the George Washington Memorial Parkway, Virginia, Maryland, and the District of Columbia

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ABSTRACT

A total of 298 taxa new to the vascular flora of the George Washington Memorial Parkway (GWMP), in Virginia, Maryland, and the District of Columbia, are documented. Additionally, 13 taxa previously known only from historical specimens are documented as still extant within GWMP. These records bring the known flora of the GWMP to 1313 taxa. Of these, 79 are known only from historical specimens. Seventeen adventive taxa may represent the first records for the Commonwealth of Virginia, and one is a first record for the District of Columbia. A total of 21 additional taxa are first records for Fairfax County and six are new records for Arlington County. Fifteen of the newly documented taxa are listed as rare within the Commonwealth, bringing the total to 37 state-rare plants found within GWMP. Taxa non-native to the District of Columbia and vicinity comprise 28.6% of the flora.

Key words: Arlington County, biodiversity, District of Columbia, Fairfax County, flora, George Washington Memorial Parkway, Maryland, Montgomery County, National Park, vascular plants, Virginia.

INTRODUCTION

The only published floras for National Park Service sites found within the George Washington Memorial Parkway (GWMP) are from the 323 ha Great Falls Park (Grimshaw & Bradley, 1973; Steury et al., 2008). The purpose of this study was to inventory all of the remaining GWMP sites comprising approximately 1659 ha and to document with a voucher specimen any species not found in Great Falls Park, thus assessing the totality of the vascular flora of the GWMP.

In addition to substantial natural areas, the GWMP contains numerous historic sites, memorials, and roadsides where non-native ornamental plant species have been introduced. Some of the Parkway's most invasive non-native plants, such as porcelainberry (*Ampelopsis brevipedunculata* (Maxim.) Trautv.), English ivy (*Hedera helix* L.), Japanese honeysuckle (*Lonicera japonica* Thunb.), amur honeysuckle (*Lonicera maackii* (Rupr.) Herder), and linden viburnum (*Viburnum dilatatum* Thunb.), were included on historical planting plans for the Parkway developed by Wilbur Simonson in 1932. These species and others have spread into nearby natural areas, including Great Falls Park, while other non-native species included on historical planting plans for GWMP have apparently remained benign. In addition to naturally established vegetation, this inventory attempted to include all woody species planted within the GWMP and to assess which species are spreading into the surrounding environment. The only exceptions included the formal gardens at Arlington House, the community gardens at Jones Point Park, flower gardens at Glen Echo Park, and the Rhododendron cultivars planted in the Lyndon Baines Johnson Memorial Grove and Lady Bird Johnson Park on Columbia Island.

STUDY SITES

The GWMP administers approximately 1982 ha under National Park Service jurisdiction in Fairfax and Arlington counties and the City of Alexandria, Virginia, Montgomery County, Maryland, and the District of Columbia (Fig. 1). The GWMP includes many sites extending from the intersection with Interstate Route 495, to its terminus at Mt. Vernon. Disjunct sites occur at Great Falls Park in Fairfax County, Virginia and the Clara Barton Parkway in Montgomery County,

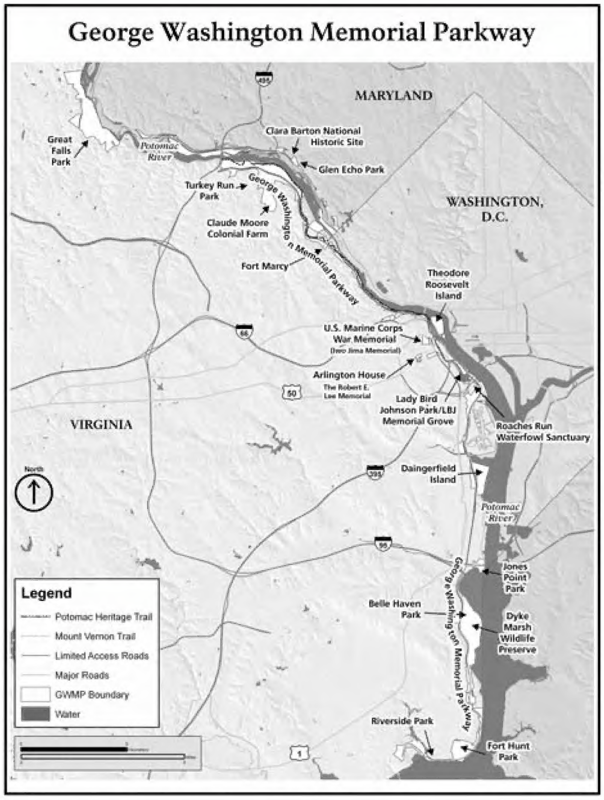
George Washington Memorial Parkway
MARYLAND
495
Great Falls Park
Potomac River
Clara Barton National Historic Site
Glen Echo Park
Turkey Run Park
George Washington Memorial Parkway
Claude Moore Colonial Farm
WASHINGTON, D.C.
Fort Marcy
Theodore Roosevelt Island
66
U.S. Marine Corps War Memorial (Iwo Jima Memorial)
Arlington House The Robert E. Lee Memorial
50
Lady Bird Johnson Park/LBJ Memorial Grove
Roaches Run Waterfowl Sanctuary
VIRGINIA
North
395
Daingerfield Island
Potomac River
95
Jones Point Park
Belle Haven Park
Dyke Marsh Wildlife Preserve
Legend
Potomac Heritage Trail
Mount Vernon Trail
Limited Access Roads
Major Roads
GWMP Boundary
Water
Riverside Park
1
Fort Hunt Park

Fig. 1. The study site, George Washington Memorial Parkway, a unit of the National Park Service, including the Clara Barton Parkway and historical sites, monuments, and natural areas.

Maryland. Significant natural areas are found at Great Falls Park (323 ha), Turkey Run Park and Claude Moore Farm (297 ha), along the Potomac Heritage Trail within the Potomac River Gorge south of Turkey Run Park (220 ha), on Theodore Roosevelt Island (40.5 ha), in the woodlots at Arlington House and the U.S. Marine Corps War Memorial (Iwo Jima Memorial, 7.8 ha), at Roaches Run Waterfowl Sanctuary (38 ha, including 22 ha of open water), on Daingerfield Island (35.5 ha), at Dyke Marsh (234.5 ha), at Fort Hunt Park (41 ha), and along the southern portions of the Mount Vernon Trail and Little Hunting Creek (57 ha). These areas fall within the region broadly classified as oak-hickory-pine forest by Skeen et al. (1993), but are strongly dominated by deciduous woodland within the park. The Dyke Marsh site contains a 131 ha tidal marsh and swamp. Although all of these sites also have maintained landscapes and yards, these are most common along the northern portions of the Mount Vernon Trail, at the Lyndon Baines Johnson (LBJ) Memorial Grove on the Potomac and Lady Bird Johnson Park, at Arlington House, and at the Clara Barton National Historic Site and Glen Echo Park. All sites occur within the Piedmont and Coastal Plain physiographic provinces.

Construction on the southern half of the GWMP (originally called the Mount Vernon Memorial Highway), which ran from Memorial Circle to Mt. Vernon, began in 1928 and was finished by 1932. The Capper-Crampton Act of 1930 authorized integrating the Mount Vernon Memorial Highway into a more extensive parkway system to be called the George Washington Memorial Parkway, which was completed in 1962. The same legislation authorized the Clara Barton Parkway in Maryland, which was completed by 1970.

MATERIALS AND METHODS

Occasional collections were made for this study between 2003 and 2006, with the bulk of the collecting taking place sporadically from 2007 through 2010 after the field work for the flora of Great Falls Park was completed (Steury et al., 2008). A voucher specimen was deposited in the GWMP Herbarium at Turkey Run Park Headquarters in McLean, Virginia for each new vascular plant taxon found. To document historical occurrences from the GWMP, computerized searches of records from the District of Columbia and Vicinity collection, in the United States National Herbarium, Smithsonian Institution (US), were made on terms such as "Theodore Roosevelt Island, Dyke Marsh, and Turkey Run". A few specimens not otherwise documented during this survey were located at the herbarium at George Mason University (GMUF).

RESULTS AND DISCUSSION

Taxonomic Summary

A total of 298 taxa, (283 species, four infraspecific taxa, and 11 hybrids), 114 genera, and 14 families were added to the vascular flora of the GWMP. Thirteen additional taxa, previously listed as historical in Great Falls Park (Steury et al., 2008) are documented as still extant within GWMP. These records bring the current total vascular flora of GWMP to 1313 taxa, representing 1284 species, 11 infraspecific taxa, and 18 hybrids from 607 genera in 153 families. Plants are comprised of 44 pteridophytes, 138 trees (16 coniferous, 122 deciduous), 148 shrubs and low suffrutescent taxa, 25 woody vines, and 958 herbaceous taxa (40 vines, 19 submerged or floating aquatic species, 119 grasses, 115 sedges, 13 rushes, and 652 forbs). These include 62 woody species that have been planted in landscapes along the GWMP which were not found naturally occurring elsewhere within GWMP. Of these 62, 14 are native to the Washington-Baltimore area as defined by Shetler & Orli (2000, 2002), but not native to GWMP based on historical voucher evidence, and 48 are non-native species. Of the 62 planted species, 12 (19.4%) (*Aesculus flava*, *Castanea mollissima*, *Cladrastris kentukea*, *Crataegus mollis*, *Hovenia dulcis*, *Koelreuteria paniculata*, *Lonicera fragantissima*, *Pyrus pyrifolia*, *Rhamnus cathartica*, *Sophora japonica*, *Ulmus parviflora*, and *Viburnum plicatum*) demonstrated evidence of escaping to other areas along the GWMP. Families having the greatest species richness are Asteraceae (135), Poaceae (119), Cyperaceae (115), Fabaceae (64), Rosaceae (64), Lamiaceae (38), and Scrophulariaceae (32). Of these, 79 are known only from historical specimens. Non-native taxa, following Shetler & Orli (2000, 2002), comprise 28.6% (375 taxa) of the vascular flora of GWMP.

State and County Records

Based on published records (Kartesz, 1999; Virginia Botanical Associates, 2010), at the time of the collections, 17 adventive, naturally established, taxa found during this study may represent the first records for the Commonwealth of Virginia: *Alnus glutinosa*, *Castanea mollissima*, *Cladrastis kentukea*, *Crataegus monogyna*, *Crocus vernus, Hovenia dulcis*, *Ilex aquifolium*, *Kalopanax septemlobus*, *Liriope muscari*, *Liriope spicatum*, *Malus baccata*, *Malus floribunda*, *Malus sieboldii*, *Skimmia japonica*, *Viburnum lantana*, *Viburnum sieboldii*, and *Vigna radiata*. The records of *Arum italicum*, *Claytonia rubra*, and *Sagina procumbens* are recent additions to the flora of the Commonwealth (Simmons et al., 2008; Steury, 2010). Twenty-one additional collections were first records for Fairfax County: *Acer palmatum*, *Aesculus flava*, *Aphanes microcarpa*, *Carex molesta*, *Crataegus mollis*, *Epipactis helleborine*, *Frangula caroliniana*, *Lonicera fragrantissima*, *Myosotis discolor*, *Nandina domestica*, *Oplismenus hirtellus* ssp. *undulatifolius*, *Pennisetum alopecuroides*, *Poncirus trifolia*, *Ranunculus parviflorus*, *Sherardia arvensis*, *Sophora japonica*, *Thlaspi alliaceum*, *Trillium luteum*, *Viburnum plicatum*, *Viburnum* x *rhytidophylloides*, and *Wisteria frutescens* (Virginia Botanical Associates, 2010). The City of Alexandria is included with Fairfax County for the purposes of the Digital Atlas of Virginia Flora (Virginia Botanical Associates, 2010). The records of *Ginkgo biloba*, *Gratiola virginiana*, *Philadelphus coronarius*, *Prunus virginiana*, *Rhamnus cathartica*, and *Urtica dioica* ssp. *gracilis* are the first for Arlington County (Harvill et al., 1992; Virginia Botanical Associates, 2010). The collection of *Pachysandra procumbens* is the first record for the District of Columbia (Kartesz, 1999; Shetler & Orli, 2000). Fifteen of the taxa reported here are listed as rare in Virginia (Townsend, 2009): *Arabis patens*, *Carex decomposita* (historical), *Carex lacustris* (historical), *Carex pallescens* (historical), *Crataegus mollis*, *Desmodium canadense* (historical), *Geum laciniatum*, *Matteuccia struthiopteris*, *Phacelia covillei*, *Plantago cordata* (historical), *Quercus hemisphaerica*, *Schoenoplectus fluviatilis*, *Sida hermaphrodita*, *Symphyotrichum shortii*, and *Viburnum lentago*. These additional records of state-rare plants increase the total known from GWMP to 37 species.

An unusual, possibly hybridized, *Quercus* of the section Lobatae was collected (*Steury 080917.1*) on Columbia Island along the shore of the Potomac River opposite the southern end of Theodore Roosevelt Island. The longest leaves measured 29.5 cm x 2.5 cm and often possess a single lobe below the middle of the leaf (Fig. 2). Three young trees with similar leaf forms occur over a distance of 15 m on a low, wet, tidal shore. The largest tree is 7 m tall and 8 cm DBH. The specimen was examined by Alan Whittemore at the National Arboretum, who suggested that the peculiar leaf shape is possibly due to a mutation causing overproduction or oversensitivity to one of the plant's hormones. The species of this peculiar form is difficult to determine because its morphology is so disturbed, but it may include *Quercus phellos* or the *Q. laurifolia* unintentionally planted in a row of *Q. phellos* at the nearby Iwo Jima Memorial.

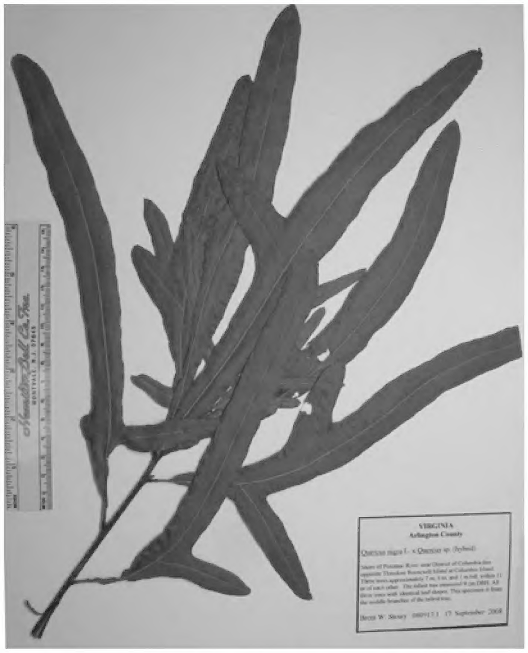

Fig. 2 *Quercus* sp. (section Lobatae), collected on Columbia Island, District of Columbia, along the shore of the Potomac River, 17 September 2008.

LIST OF SPECIES

Families, genera, and species are arranged alphabetically within major taxonomic groups. Nomenclature follows Kartesz (1999) with the exceptions of *Stachys hispida* which follows Gleason & Cronquist (1991) and Weakley (2008), *Atriplex dioica* follows Welsh (2003), *Chimonanthus praecox* follows Li & Barthotomew (2008), and *Skimmia japonica* which follows Ohwi (1965). Taxa not native to the Washington–Baltimore area are marked with an asterisk. Nativity follows Shetler & Orli (2000, 2002). Taxa not marked with an asterisk, but described as "planted" in the list of species, should be considered non-native to the GWMP. Taxa last collected prior to 1969 are noted as "historical" and their most recent year of collection from the Parkway is cited. Taxa listed as rare in Virginia are marked with a double asterisk. Collection numbers are given when known. Collection numbers of the author correspond to the date of the collection (e.g., 070823.4 is the fourth specimen collected on 23 August 2007). The name of the collector and date of the collection are cited when the collection was made by someone other than the author. The county, location, and habitat of the taxon, and information on species abundance, are listed when known. Specimens are deposited in the GWMP Herbarium at Turkey Run Park Headquarters in McLean, Virginia unless noted otherwise after the collection number.

PTERIDOPHYTES

DRYOPTERIDACEAE

Diplazium pycnocarpon (Spreng.) Broun–*070823.4*, Fairfax County, Turkey Run Park, Potomac River floodplain, rare in a few small patches north of Turkey Run.

Dryopteris goldiana (Hook. ex Goldie) Gray–*15422 G.P. Fleming*, 16 August 2006, Fairfax County, Turkey Run Park, rich wooded bouldery slope above Potomac River floodplain between Turkey Run and Dead Run, about 12 plants.

***Matteuccia struthiopteris* (L.) Todaro–*070823.3*, Fairfax County, Turkey Run Park, Potomac River floodplain, thousands of plants in patches along the entire length of the park.

OPHIOGLOSSACEAE

Ophioglossum vulgatum L.–*090429.3*, Fairfax County, edge of swampy drainage along southbound GWMP north of Little Hunting Creek, 16 plants in one patch. This species was reported as historical in Great Falls Park.

PTERIDACEAE

Pellaea atropurpurea (L.) Link–*s.n. W. Palmer* (US), 6 July 1877, District of Columbia, Theodore Roosevelt Island (historically known as Analostan Island), causeway, historical.

GYMNOSPERMS

CUPRESSACEAE

**Cryptomeria japonica* (L.f.) D. Don.–*090413.1*, Arlington County, planted in median area west of parking lot at Arlington House.

**Platycladus orientalis* (L.) Franco–*090413.4*, Arlington County, planted in median area west of parking lot at Arlington House.

Taxodium distichum (L.) L.C. Rich.–*080423.2*, District of Columbia, Theodore Roosevelt Island, undoubtedly planted; also planted in Arlington County at the north end of Roaches Run Waterfowl Sanctuary.

Thuja occidentalis L.–*080312.4*, Fairfax County, southbound GWMP opposite Ft. Marcy, persisting at old home site. Also observed as plantings along the Mt. Vernon trail south of Daingerfield Island and on the east side of Arlington House.

GINKGOACEAE

**Ginkgo biloba* L.–*090423.2*, Arlington County, escaped in woods north of Arlington House, two young trees.

PINACEAE

**Cedrus deodara* (Roxb. Ex D. Don) G. Don f.–*080327.1*, City of Alexandria, planted on Daingerfield Island; also planted behind Arlington House.

**Picea abies* (L.) Karst–*080312.6*, Fairfax County, old home site along southbound GWMP opposite Ft. Marcy, one tree.

Pinus pungens Lamb.–*080310.1*, Fairfax County, Turkey Run Park, near crest of slope above eastern bank of Dead Run, three trees, the two largest measured 32.5 cm and 41.2 cm DBH.

Pinus rigida P. Mill.–*100126.1*, Arlington County, near Fairfax County line, bank crest of Pimmit Run on south side of GWMP, one tree.

Pinus taeda L.–*080324.3*, City of Alexandria, planted along GWMP just south of Four Mile Run, fruiting. There are no naturally occurring stands of this species known from GWMP.

TAXACEAE
**Taxus baccata* L.–*080312.5*, Fairfax County, southbound GWMP opposite Ft. Marcy, persisting at old home site.

DICOTYLEDONS

ACERACEAE
**Acer campestre* L.–*090729.1*, planted or possibly escaped between southern terminus Mt. Vernon Trail and GWMP, three small trees.

**Acer griseum* (Franchet) Pax–*090428.3*, Arlington County, planted in median area west of parking lot at Arlington House.

**Acer palmatum* Thumb.–*080407.2*, Fairfax County, Turkey Run Park, roadside, one large tree. This is an uncommon, but well established, introduced species in most woodlands along the GWMP.

AMARANTHACEAE
**Alternanthera philoxeroides*–*100909.1*, Fairfax County, Dyke Marsh, edge of tidal marsh along Potomac River.

Amaranthus albus L.–*080610.9*, District of Columbia, Humpback Bridge, crack in cement curbing.

**Amaranthus blitum* L.–*070904.7*, District of Columbia, Columbia Island, in bare soil in turf grass area at south end of island.

Amaranthus cannabinus (L.) Sauer–*070829.15*, District of Columbia, Columbia Island, Boundary Channel, in water at edge of channel. Common in most GWMP coastal plain wetlands.

Amaranthus retroflexus L.–*1250 P. Fleming* (US), 11 August 1989, District of Columbia, Columbia Island.

ANACARDIACEAE
Rhus glabra L.–*070829.32*, Fairfax County, Dyke Marsh, common along Haul Road.

APIACEAE
Eryngium aquaticum L.–*s.n. L.F. Ward* (US), 19 August 1877, Arlington County, Roaches Run, historical.

Oxypolis rigidior (L.) Raf.–*090429.4*, Fairfax County, hummock in swampy drainage along southbound GWMP north of Little Hunting Creek, one patch of 11 plants. This plant is also fairly common in the swamp forest of Dyke Marsh.

Sanicula trifoliata Bickn.–*080624.3*, Fairfax County, Turkey Run Park, rich deciduous floodplain woods along Potomac Heritage Trail below parking area C-1, 11 plants along 50 m of trail side.

APOCYNACEAE
**Vinca major* L.–*080407.8*, Fairfax County, Dyke Marsh, along entrance road to Belle Haven Marina, one small patch.

**Vinca minor* L. 'Elizabeth Cran'–*090413.8*, Arlington County, this is the dark purple double flowered cultivar of *V. minor* that is invasive in woodlands north of Arlington House.

AQUIFOLIACEAE
**Ilex* x *altaclerensis* (Loud.) Dallim.–*080327.18*, City of Alexandria, Daingerfield Island, apparently planted, persisting in wooded areas that were once a tree nursery.

**Ilex aquifolium* L.–*090625.1*, Fairfax County, escaped along Potomac Heritage Trail north of Ft. Marcy, one tree 3 m tall.

**Ilex x attenuata* Ashe–*080327.20*, City of Alexandria, Daingerfield Island, apparently planted, persisting in wooded areas that were once a tree nursery.

* *Ilex cornuta* Lindl. & Paxton–*080327.19*, City of Alexandria, Daingerfield Island, apparently planted, persisting in wooded areas that were once a tree nursery.

**Ilex crenata* Thunb.–*080519.23*, Fairfax County, edge of swamp along Mt. Vernon Trail opposite Cigarette Turnaround. This shrub is a common roadside escape along the GWMP especially between the Rt. 123 exits and Dyke Marsh.

**Ilex* x *koehneana* Loesner–*080327.17*, City of Alexandria, Daingerfield Island, apparently planted, persisting in wooded areas that were once a tree nursery.

ARALIACEAE
**Kalopanax septemlobus* (Thunb. ex A. Murr.) Koidz–*100422.1*, Fairfax County, beech woods along

Little Hunting Creek, 0.5 km north of Mt. Vernon, one young tree.

Panax quinquefolius L.–*080626.5*, Fairfax County, Turkey Run Park, rich deciduous woods on east-facing bank slope above Turkey Run, rare but widespread, often occurring as single plants.

Panax trifolius L.–*070414.1*, Fairfax County, Turkey Run Park, rich deciduous floodplain woods along Potomac Heritage Trail, uncommon.

ASTERACEAE

Baccharis halimifolia L.–*060920.1*, Fairfax County, Jones Point Park, edge of marsh near mouth of Hunting Creek, five shrubs.

Bidens laevis (L.) B.S.P.–*070926.8*, Fairfax County, Dyke Marsh, abundant throughout.

**Cardus nutans* L. ssp. *macrolepis* (Peterm.) Kazmi–*080603.3*, Arlington County, GWMP southbound roadside at Roaches Run, hundreds of plants.

**Centaurea calcitrapa* L.–*253 G.H. Shull* (US), 23 August 1902, City of Alexandria, Jones Point Park, near lighthouse, historical.

**Chondrilla juncea* L.–*080724.1*, Arlington County, bank of Roaches Run Waterfowl Sanctuary, rare.

Cirsium altissimum (L.) Spreng.–*s.n. L.F. Ward* (US), 22 July 1876, above Aqueduct Bridge (present-day Key Bridge), historical.

**Cirsium arvense* (L.) Scop.–*070829.3*, Arlington County, along Potomac Heritage Trail near Spout Run. This species was also found in Great Falls Park in July 2009.

Coreopsis tinctoria Nutt.–*070926.4*, District of Columbia, Columbia Island, crest of Potomac River, a few plants growing from large *Ampelopsis brevipedunculata* vine tangle.

Eupatorium sessilifolium L.–*100506.1 J.M. Parrish & B.W. Steury*, Arlington County, Potomac River bluff at mouth of Gulf Branch, four small clumps.

Euthamia graminifolia (L.) Green–*081112.2*, Fairfax County, under powerline near Claude Moore Farm, fairly common at this site.

Helianthus tuberosus L.–*070924.2*, Fairfax County, Belle Haven, Potomac River shore, at least one hundred plants; also observed along Potomac River shore in Turkey Run Park.

Hieracium paniculatum L.–*100715.2 with J. Parrish*, Arlington County, southern side of the mouth of Gulf Branch, at least 20 plants.

**Hypochaeris radicata* L.–*080519.22*, Fairfax County, along edge of Mt. Vernon Trail / GWMP roadside near Hog Gut in Dyke Marsh, rare.

**Lactuca saligna* L.–*317 R. Kanal* (US), 10 September 1988, District of Columbia, Columbia Island.

**Lactuca serriola* L.–*070829.12*, Arlington County, along Potomac Heritage Trail north of Theodore Roosevelt Island, a common weed.

Pluchea odorata (L.) Cass.–*100826.1 with I. Steury*, Fairfax County, Potomac River gravel shore just south of Collingwood exit, two plants.

Polymnia canadensis L.–*080729.1*, Fairfax County, Potomac River floodplain along Potomac Heritage Trail south of Wisteria Run, three patches with a total of approximately 40 plants, also observed along Dead Run.

Prenanthes altissima L.–*6094 G. Fleming and B. Fleming* (GMUF), 20 September 1991, Fairfax County, Turkey Run Park, moist rich wooded bluff above Potomac River.

Symphyotrichum puniceum (L.) A.&D. Löve–*080918.2*, City of Alexandria, Daingerfield Island, edge of swamp along boardwalk, at least 12 flowering stems.

Symphyotrichum subulatum (Michx.) Nesom–*s.n. S.G. Shetler* (US), 12 October 1979, Fairfax County, Dyke Marsh.

***Symphyotrichum shortii* (Lindl.) Nesom–*s.n. E.S. Burgess* (US), 2 October 1888, Violets Rock at Spout Run (this species is still extant in this general vicinity but not recently collected).

**Youngia japonica* (L.) DC.–*080603.1*, District of Columbia, Columbia Island, under white pine stand on north end of island. This species was also observed in Great Falls and Turkey Run Parks, Fairfax County.

BERBERIDACEAE

**Berberis julianiae* Schneid.–*090505.3*, Arlington County, planted in hedge rows on west side of Arlington House near bus stop.

Caulophyllum thalictroides (L.) Michx.–*080415.1*, Fairfax County, Turkey Run Park, rich deciduous floodplain woods, especially common near Dead Run.

**Mahonia aquifolium* (Pursh) Nutt.–*080401.1*, Fairfax County, Turkey Run Park, planted near park police substation.

**Mahonia bealei* (Fortune) Carr.–*070829.23*, Fairfax County, edge of woodland near southern terminus of Mount Vernon Trail. This species is also well established along the Potomac Heritage Trail between the 123 exits and Fort Marcy.

**Nandina domestica* Thunb.–*080312.2*, Fairfax County, escaped in rich deciduous woods along Potomac Heritage Trail south of Rt. 123 exits, rare.

BETULACEAE

**Alnus glutinosa* (L.) Gaertn.–*090629.2 J. Parrish, R. Simmons, E. Oberg & B. Steury*, Arlington County, escaped on southern shore of Roaches Run, one large shrub. This non-native tree was also collected in Fairfax County along Pimmit Run, *100503.4*.

Corylus americana Walt.–*070829.2*, Fairfax County, bank of Pimmit Run near GWMP Bridge, approximately 20 shrubs; also common along an unnamed stream under powerline at Claude Moore Farm.

BIGNONIACEAE

Bignonia capreolata L.–*081022.1*, Arlington County, along tree line on southbound side of GWMP opposite Regan Washington National Airport, probably persisting from a historical planting at a nearby site.

BORAGINACEAE

**Buglossoides arvensis* (L.) I.M. Johnston–*080407.3*, Fairfax County, Turkey Run Park, northbound GWMP roadside at Turkey Run, about 50 plants at this site.

Hackelia virginiana (L.) I.M. Johnson–*090428.8*, Fairfax County, rich deciduous woods along Potomac Heritage Trail between 123 exits and Ft. Marcy, rare.

**Myosotis discolor* Pers.–*090507.6*, City of Alexandria, roadside median area opposite Daingerfield Island, hundreds of plants.

Myosotis laxa Lehm.–*080519.15*, Fairfax County, Dyke Marsh, wet ditch along Mt. Vernon Trail, approximately 50 plants. This species was historically collected at Great Falls Park.

Myosotis macrosperma Engelm.–*080519.29*, District of Columbia, Theodore Roosevelt Island, trailside on southeastern side of island, 17 plants observed.

BRASSICACEAE

***Arabis patens* Sull.–*060420.1*, Fairfax County, Turkey Run Park, sandy, rocky floodplain near mouth of southern shore of Turkey Run, one plant with 11 flowering stems.

**Brassica rapa* L.–*080327.5*, District of Columbia, Columbia Island, common weed in flowerbeds at LBJ Memorial Grove.

**Capsella bursa-pastoris* (L.) Medik.–*080424.8*, District of Columbia, Columbia Island, fairly common weed in flowerbeds and lawns.

**Rorippa nasturtium-aquaticum* (L.) Hayek–*090518.2*, Fairfax County, first stream under power line at Claude Moore Farm, one small patch 0.5 m x 0.3 m.

**Sisymbrium officinale* (L.) Scop.–*080428.8*, Fairfax County, Dyke Marsh, edge of gravel along Haul Road; also common in flowerbeds at LBJ Memorial Grove.

**Thlaspi alliaceum* L.–*080416.4*, City of Alexandria, Daingerfield Island, edge of Mt. Vernon Trail, 11 plants.

**Thlaspi arvense* L.–*080416.5*, District of Columbia, Columbia Island, an uncommon weed in flower beds at LBJ Memorial Grove.

BUXACEAE

**Buxus sempervirens* L.–*080401.3*, Fairfax County, Turkey Run Park, planted near trailer north of Resource Management Building and other GWMP sites with buildings.

Pachysandra procumbens Michx.–*040318.1 D. Sealy, B Steury & D. Pavek*, District of Columbia, Theodore Roosevelt Island, deciduous woods near center of island, one patch measuring 4.3 m x 1.2 m. The nativity of this species at this site is doubtful.

**Pachysandra terminalis* Sieb. & Zucc.–*080312.3*, Fairfax County, old home site on southbound GWMP opposite Ft. Marcy, hundreds of plants in one large patch.

CALYCANTHACEAE
**Chimonanthus praecox* (L.) Link–*080320.11*, City of Alexandria, Daingerfield Island, evidently planted and persisting in areas that are now woodlands.

CAPRIFOLIACEAE
**Abelia* x *grandiflora* (Andre) Rehd.–*070926.50*, District of Columbia, Columbia Island, planted near Navy and Marine Memorial.

**Lonicera fragrantissima* Lindl. & Paxton–*080315.1*, Fairfax County, woodland edge along southbound GWMP just south of West Boulevard Drive exit, a few shrubs; *080327.6*, Fairfax County, persisting and likely spreading from plantings at old home site on southbound GWMP opposite Ft. Marcy.

Lonicera sempervirens L.–*090413.7*, Arlington County, gravel terrace woodland north of Arlington House, uncommon, this is the only known location for this species in GWMP.

**Lonicera xylosteum* L.–*s.n. L.K. Thomas* (US), 7 May 1963, District of Columbia, Theodore Roosevelt Island, historical.

Sambucus racemosa L.–*090827.1*, Turkey Run Park, along Potomac Heritage Trail on bank of Potomac River near eastern end of park, one shrub.

**Viburnum carlesii* Hemsl.–*080410.1*, Arlington County, planted around GWMP maintenance building.

**Viburnum lantana* L.–*090421.1*, City of Alexandria, escaped on bank of Potomac River at southern end of Mirant Power Plant, one shrub.

***Viburnum lentago* L.–*090507.2*, City of Alexandria, two shrubs in roadside ditch along southbound GWMP opposite Daingerfield Island. According to historic planting plans this species was planted along the GWMP. These two shrubs are likely descendants of those plantings however they are no longer visible from the parkway.

**Viburnum plicatum* Thumb.–*070507.1*, Fairfax County, Turkey Run Park, escaped in rich deciduous woods, one shrub; *090511.1*, Fairfax County, Dead Run Swamp, three shrubs. This species has also been planted at Turkey Run Park and LBJ Grove.

**Viburnum* x *rhytidophylloides* Sur. –*080428.5*, Fairfax County, planted along Crest Lane, a few plants escaping to or persisting in nearby deciduous woods.

**Viburnum sieboldii* Miq.–*100422.1*, Arlington County, well established escape in deciduous woodland in wet soils along a drainage between the GWMP and Fort C.F. Smith. To my knowledge this species has not been planted along the GWMP.

**Weigela florida* (Bunge) A. DC.–*090505.4*, Arlington County, planted in median area west of parking lot at Arlington House.

CARYOPHYLLACEAE
**Holosteum umbellatum* L.–*090408.3*, Fairfax County, edge of Potomac River Gorge approximately 150 m south of Overlook One, approximately 20 plants.

**Sagina procumbens* L.–*090505.1*, Arlington County, crack in asphalt pavement at Arlington House parking lot, a few clumps.

**Scleranthus annuus* L.–*080410.3*, Fairfax County, common along GWMP roadside at overlook one and other roadside turf grass sites.

**Spergularia rubra* (L.) J. & K. Presl.–*070523.1*, Fairfax County, Turkey Run Park, roadside near entrance to headquarters, hundreds of plants.

CELASTRACEAE
**Euonymus kiautschovica* Loes.–*080327.4*, Arlington County, shore of Boundary Channel just south of inlet to Potomac River, becoming naturalized in GWMP.

CHENOPODIACEAE
Atriplex dioica Raf.–*081002.1*, City of Alexandria, Daingerfield Island, maintenance yard.

CLETHRACEAE
Clethra alnifolia L.–*060907.1*, Fairfax County, Turkey Run Park, edge of woods near parking area C-2, probably planted, at least 12 shrubs. This species is also planted in LBJ Memorial Grove. There are no naturally occurring populations in GWMP, and the plantings are likely spreading vegetatively.

CONVOLVULACEAE
**Convolvulus arvensis* L.–*080610.5*, District of Columbia, Columbia Island, GWMP roadsides, common.

**Ipomoea coccinea* L.–*070910.3*, City of Alexandria, Daingerfield Island, along Mount Vernon Trail, rare.

CORNACEAE
Cornus alternifolia L.f.–*100503.1 J.M. Parrish & B.W. Steury*, Fairfax County, Turkey Run Park, rocky base of slope on western side of Dead Run, one young tree. There are also historical records for this species collected from our area between 1877 and 1926 such as S.F. Blake's 1926 voucher *9371* (US) collected "opposite Plummer's Island."

**Cornus kousa* Hance–*080908.1*, Fairfax County, a few trees planted on GWMP southbound roadside between Collingwood Road exit and Mt. Vernon.

**Cornus mas* L.–*080603.4*, Fairfax County, widely planted along the GWMP between Turkey Run and south of Belle Haven, no definite evidence of plants escaping.

Cornus racemosa Lam.–*090611.8*, Fairfax County, planted along southern terminus of Mt. Vernon Trail at one site.

ERICACEAE
**Enkianthus campanulatus* (Miq.) Nichols–*100505.1*, Fairfax County, Turkey Run Park, planted near park headquarters building.

Vaccinium caesariense Mackenzie–*090413.3*, Fairfax County, hummocks in vernal pool along southbound GWMP south of Little Hunting Creek, a few shrubs.

FABACEAE
Amorpha fruticosa L.–*070829.26*, Fairfax County, Dyke Marsh, Potomac shore along Haul Road, common at this site.

Chamaecrista fasciculata (Michx.) Greene–*100721.1,* Arlington County, Potomac Heritage Trail, a clump of eight plants between Spout Run and Donaldson Run; also historically collected at Great Falls Park.

Cladrastis kentukea (Dum.-Cours.) Rudd.–*060615.2*, Fairfax County, along Mount Vernon Trail near southern terminus, a few large trees, evidently planted, and numerous saplings escaping in nearby areas.

***Desmodium canadense* (L.) DC.–*216 G.H. Shull* (US), 13 August 1902, City of Alexandria, Jones Point Park, near lighthouse, historical.

**Lathyrus latifolius* L.–*101008.1*, Arlington County, bank of Four Mile Run at GWMP, a few plants.

**Sophora japonica* L.–*070829.17*, District of Columbia, Columbia Island, bank of Boundary Channel, abundant, mature fruiting trees and numerous young saplings; *080716.1*, Fairfax County, Dyke Marsh, edge of woods along Haul Road. This species was planted in LBJ Memorial Grove and is now an abundant escape along the bank of Boundary Channel and the Potomac River shore at least from Spout Run to Dyke Marsh.

Strophostyles helvula (L.) Ell.–*070829.35*, Fairfax County, Dyke Marsh, along edge of Haul Road, one patch about 1 m x 1 m. This species is known from historical collections at Great Falls Park.

**Vicia tetrasperma* (L.) Schreb.–*1168 P. Fleming* (US), 24 June 1989, District of Columbia, Columbia Island.

**Vicia villosa* Roth–*080610.8*, District of Columbia, Columbia Island, between Mt. Vernon Trail and Potomac River, rare; also historically known from Great Falls Park.

**Vigna radiata* (L.) R. Wilczek–*100830.1 with C.A. Davis*, Fairfax County, Great Falls Park, Sandy Landing, one plant growing in sand between Potomac River and boat ramp.

Wisteria frutescens (L.) Poir.–*080519.26*, City of Alexandria, Daingerfield Island, edge of creek flowing into Potomac River and southern end of island, well established at this site.

FAGACEAE
**Castanea mollissima* Blume–*080731.2*, Fairfax County, Riverside Park, escaped along shore of Potomac River, one tree. This species is planted in Belle Haven picnic area at Dyke Marsh, Fairfax County and on Columbia Island, District of Columbia.

Castanea pumila Mill.–*050531.1*, Fairfax County, Fort Marcy, east side of earthworks, one tree about 3 m tall.

**Quercus acutissima* Carruthers–*070904.4*, City of Alexandria, Daingerfield Island, commonly planted.

***Quercus hemisphaerica* Bartr. ex Willd.–*070327.15*, City of Alexandria, Daingerfield Island, one young tree, perhaps the progeny of a tree once planted on the island.

Quercus x *heterophylla* Michx.–*080922.1*, Arlington

County, bank of Potomac River opposite the middle of Theodore Roosevelt Island, one tree measuring 89.4 cm DBH.

**Quercus laurifolia* Michx.–*090217.1*, Arlington County, two large trees planted on southbound side of GWMP opposite Regan Washington National Airport. Also, four trees are planted in a line of *Q. phellos* at the Iwo Jima Memorial.

Quercus lyrata Walter–*061017.1*, Fairfax County, Belle Haven picnic area. This species is widely planted and long persisting, but naturally absent, along the GWMP from Belle Haven to near Mount Vernon.

Quercus macrocarpa Michx.–*100929.3*, Arlington County, one large tree planted at north end of Gravelly Point along railroad overpass.

Quercus marilandica Muenchh.–*s.n., G. Zell*, 7 November 2008, Arlington County, Pimmit Run near GWMP on dry west-facing slope, one tree.

**Quercus robur* L.–*090729.2*, Fairfax County, two trees planted on eastern side of Mt. Vernon Trail near southern terminus.

Quercus sect. Lobatae–*080917.1*, District of Columbia, Columbia Island, low, wet, tidal shore along Potomac River opposite southern end of Theodore Roosevelt Island near Arlington County line, three young trees with similar leaf forms over an area of 15 m, all vegetative, Fig. 2.

GERANIACEAE
**Erodium cicutarium* (L.) L'Hér. ex Ait.–*090518.10*, Fairfax County, roadside bank along northbound GWMP at 123 on-ramp, approximately 100 plants.

**Geranium molle* L.–*080428.2*, Fairfax County, lawns at Belle Haven picnic area, abundant along GWMP roadsides.

**Geranium pusillum* L.–*080610.7*, District of Columbia, Columbia Island, in turf grass along Mt. Vernon Trail, a few plants.

GROSSULARIACEAE
Itea virginica L.–*080519.24*, Fairfax County, Dyke Marsh, edge of swamp along Mt. Vernon Trail opposite Cigarette Turnaround, rare; also observed at Roaches Run, Arlington County.

HALORAGACEAE
**Myriophyllum spicatum* L.–*070926.11*, Fairfax County, Dyke Marsh, a common aquatic species in bays of Dyke Marsh.

HAMAMELIDACEAE
**Hamamelis mollis* Oliver–*090224.1*, Arlington County, planted along southbound GWMP roadside at second exit for Regan Washington National Airport.

Liquidambar styraciflua L.–*070829.38*, Fairfax County, Dyke Marsh, common along Haul Road, also observed at most other GWMP Coastal Plain sites but absent above the Fall Line.

HIPPOCASTANACEAE
**Aesculus* x *carnea* Hayne–*090507.3*, City of Alexandria, Daingerfield Island, planted near greenhouse offices.

Aesculus flava Ait.–*080428.4*, Fairfax County, Dyke Marsh, Belle Haven, probably historically planted in the area, now escaping along the Haul Road entrance and surrounding areas, numerous young trees; also planted in the District of Columbia at LBJ Memorial Grove.

**Aesculus glabra* Willd.–*080428.3*, Fairfax County, Dyke Marsh, Belle Haven, one tree planted near restrooms in picnic area.

HYDRANGEACEAE
**Deutzia scabra* Thunb.–*090616.2*, Montgomery County, planted on western side of Clara Barton House.

**Philadelphus coronarius* L.–*090428.2*, Arlington County, deciduous woods north of Arlington House, a few shrubs.

HYDROPHYLLACEAE
Hydrophyllum virginianum L.–*080423.1*, District of Columbia, Theodore Roosevelt Island, rich woods along trail in southwestern corner of island, uncommon; also observed in Turkey Run Park.

***Phacelia covillei* S. Wats.–*090514.1*, FairfaxCounty, abundant along eastern side of Dead Run floodplain south of GWMP. This species is common within GWMP on floodplains in the Potomac River Gorge of Maryland and Virginia and is also occasionally found at upland sites above the Gorge and along nearby tributaries, especially Dead Run.

LAMIACEAE
**Ajuga reptans* L.–*090421.3*, Fairfax County, along Potomac Heritage Trail between 123 exits and Ft. Marcy, a few plants.

**Calamintha nepeta* (L.) Savi–*1364 P. Fleming* (US), 2 October 1991, District of Columbia, Columbia Island, shore of Potomac.

**Chaiturus marrubiastrum* (L.) Reichenb.–*090813.1*, Fairfax County, Turkey Run Park, bank of Potomac River, approximately 10 plants.

Physostegia virginiana (L.) Benth.–*080716.3*, Arlington County, boulder outcrop in Potomac River just north of Spout Run, at least 100 stems; also observed near lighthouse on shore of Potomac at Jones Point, City of Alexandria.

Pycnanthemum virginianum (L.) T. Dur. & B.D. Jackson ex B.L. Robins & Fern.–*s.n. L.F. Ward* (US), 19 October 1879, Arlington County, Roaches Run, historical.

Stachys hispida Pursh.–*070829.30*, Fairfax County, Dyke Marsh, Potomac shore along Haul Road, approximately 30 plants.

LARDIZABALACEAE
**Akebia quinata* (Houtt.) Dcne.–*070822.1*, Montgomery County, Clara Barton Parkway, just north of Chain Bridge, an abundant invasive species in this area.

LYTHRACEAE
Cuphea viscosissima Jacq.–*060927.1*, Arlington County, crest of southern bank slope of Pimmit Run near Chain Bridge, Arlington County, at least 20 plants.

**Lagerstroemia indica* L.–*070904.1*, District of Columbia, Columbia Island, shore of Boundary Channel, probably escaped.

**Lythrum salicaria* L.–*070829.40*, Fairfax County, Dyke Marsh, uncommon but widespread in the marsh.

MAGNOLIACEAE
**Magnolia grandiflora* L.–*080313.1*, Fairfax County, southbound GWMP roadside, an uncommon but consistent escape between Dyke Marsh and Mt. Vernon.

**Magnolia* x *soulangiana* Soul.-Bod.–*080320.1*, Fairfax County, Turkey Run Park, planted near maintenance shed.

MALVACEAE
Hibiscus moscheutos L.–*070829.31*, City of Alexandria, Daingerfield Island, edge of swamp near north end of boardwalk; also observed in most large GWMP Coastal Plain wetlands.

**Malva neglecta* Wallr.–*070829.6*, Arlington County, along Potomac Heritage Trail near Spout Run, rare.

**Malva sylvestris* L.–*1246 P. Fleming* (US), 11 August 1989, District of Columbia, Columbia Island, shore of Potomac.

***Sida hermaphrodita* (L.) Rusby–*070829.5*, Arlington County, along Potomac Heritage Trail on shore of Potomac River, three stems growing from large vine tangle of *Ampelopsis brevipedunculata*. Weed management at the site has increased the population to 16 plants by August 2009. Plants as short as 30 cm observed in flower.

MORACEAE
**Ficus carica* L.–*090616.1*, Montgomery County, planted on east and south sides of the Clara Barton Home.

MYRICACEAE
Morella cerifera (L.) Small–*080327.8*, Arlington County, shore of Boundary Channel just south of inlet from Potomac River, possibly an escape from nearby plantings along GWMP roadside north of Daingerfield Island, no obviously native populations known from GWMP, one patch about 10 m x 5 m.

NYMPHAEACEAE
Nuphar lutea (L.) Sm. ssp. *advena* (Ait.) Kartesz & Gandhi–*070829.24*, Fairfax County, Dyke Marsh, the dominant component of low mash areas; also historically known from Great Falls Park.

OLEACEAE
**Fraxinus excelsior* L.– *070904.54*, Fairfax County, Belle Haven, picnic area, a few trees planted near the Potomac River, trees old but small and depauperate evidently due to acidic soil conditions; also planted in picnic area at Great Falls Park and along the Potomac River at Gravelly Point in Arlington County. It is probably mistakenly being sold as *Fraxinus nigra* Marsh.

Fraxinus profunda (Bush) Bush–*070926.1*, Fairfax County, Dyke Marsh, common along tidal shores of marsh.

**Ligustrum ovalifolium* Hassk.–*090611.2*, Fairfax County, edge of swamp at Dyke Marsh near River Farm Drive, one shrub.

**Ligustrum japonicum* Thunb.–*080110.1*, City of Alexandria, Daingerfield Island, three shrubs on bank of Potomac River; also well established along the southbound side of the GWMP opposite Dyke Marsh.

**Ligustrum sinense* Lour.–*080519.34*, District of Columbia, Theodore Roosevelt Island, edge of trail on north end of island, a few shrubs.

ONAGRACEAE
Epilobium coloratum Biehler–*1439 R.H. Simmons & M.T. Strong*, 10 August 2003, City of Alexandria, Jones Point Park, moist to wet open areas.

Ludwigia decurrens L.–*060920.3*, Fairfax County, Jones Point Park, edge of marsh near mouth of Hunting Creek, at least 6 plants. This species is also present on Daingerfield Island and at Dyke Marsh.

Oenothera laciniata Hill.–*1160 P. Fleming* (US), 24 June 1989, District of Columbia, Columbia Island.

PAPAVERACEAE
**Chelidonium majus* L.–*030519.1*, Fairfax County, Turkey Run Park, sandy floodplain along Potomac River near Soapstone Valley, a few plants.

PASSIFLORACEAE
**Passiflora incarnata* L.–*070829.9*, Arlington County, along Potomac Heritage Trail near Key Bridge, patch approximately 20 m x 4 m, and at northern end of Gravelly Point along railroad overpass.

PLANTAGINACEAE
***Plantago cordata* Lam.–*11534 P.C. Standley* (US), 19 May 1915, City of Alexandria, Jones Point Park, in Potomac River near lighthouse, historical.

POLYGALACEAE
Polygala mariana P. Mill.–*080724.7*, Fairfax County, along Mount Vernon Trail just north of Collingwood Road exit, bare turf grass area, at least 20 plants.

POLYGONACEAE
Polygonum erectum L.–*100422.2*, Fairfax County, GWMP southbound roadside near Dead Run, fairly common roadside species in this area. This species was reported as historical in Great Falls Park.

Rumex verticillatus L.–*080519.28*, District of Columbia, Theodore Roosevelt Island, fringe swamp near bridge to island, common at this site.

PORTULACACEAE
**Claytonia rubra* (T.J. Howell) Tidestrom–*090407.1*, Arlington County, edge of Potomac River Gorge south of southernmost overlook about 25 m from GWMP, at least 163 plants.

RANUNCULACEAE
**Ranunculus parviflorus* L.–*080402.1*, Fairfax County, Claude Moore Farm, disturbed area around gift shop, approximately 30 plants; *080519.4*, Fairfax County, Belle Haven picnic area, turf grass near restrooms, rare. It was also observed at Ft. Hunt.

**Ranunculus repens* L.–*s.n. P.C. Standley* (US), 19 May 1915, City of Alexandria, Jones Point Park, near lighthouse, historical. This species was also historically collected on Theodore Roosevelt Island in the District of Columbia.

RHAMNACEAE
Frangula caroliniana (Walt.) Gray–*080811.3*, City of Alexandria, Daingerfield Island, edge of woods on southwestern side near Mt. Vernon Trail, probably escaped or planted, one multi-trunked tree.

**Hovenia dulcis* Thunb.–*060615.4*, Fairfax County, along Mount Vernon Trail near southern terminus, probably planted, a few large trees with seedlings present in nearby woods.

**Rhamnus cathartica* L.–*080724.3*, Arlington County, bank of Roaches Run Waterfowl Sanctuary along GWMP, probably planted historically, now escaping and widespread near Roaches Run. This species is also planted at Rt. 123 exits off GWMP.

ROSACEAE
Agrimonia parviflora Ait.–*081112.3*, Fairfax County,under powerline near Claude Moore Farm, uncommon. This species is historically known from Great Falls Park.

**Aphanes microcarpa* (Boiss. & Reut.) Rothm.–*080522.2*, Fairfax County, northbound GWMP roadside at Collingwood exit, thousands of plants, also found at Ft. Hunt *100505.1*.

**Chaenomeles speciosa* (Sweet) Nakai–*080327.7*, Fairfax County, southbound GWMP roadside just north of Ft. Marcy, probably planted and long persisting near old home site.

**Cotoneaster salicifolius* Franchet–*080403.5*, District of Columbia, Columbia Island, planted at the base of LBJ Memorial.

***Crataegus mollis* Scheele–*070829.20*, Fairfax County, Belle Haven, woodlot just north of Dyke Marsh, probably historically planted, now escaping and established along edge of woods and Mount Vernon Trail.

**Crataegus monogyna* Jacq.–*041017.1 with G. Fleming*, Fairfax County, Turkey Run Park, trailside through deciduous woods south of headquarters, one shrub. *090625.2*, Fairfax County, along Potomac Heritage Trail north of Ft. Marcy, two shrubs.

***Geum laciniatum* Murray–*060615.1*, Fairfax County, Dyke Marsh, along Haul Road on peninsula near boardwalk, nine plants.

**Malus baccata* (L.) Borkh.–*090413.2*, Fairfax County, escaped along GWMP roadsides north and south of Rt. 123 exits.

**Malus floribunda* Sieb. Ex Van Houtte–*090413.3*, Fairfax County, escaped along GWMP roadsides near Rt. 123 exits, on the southern portions of the parkway, and in woods at Arlington House.

**Malus* cf. *prunifolia* (Willd.) Borkh.–*090413.4*, City of Alexandria, planted at Jones Point Park near lighthouse. This tree is apparently hybridized with another unknown *Malus* species.

**Malus sieboldii* (Regel) Rehd.–*100422.3*, Fairfax County, escaped in moist deciduous woods on bank of Dead Run near GWMP, one tree. This species was also observed on the bank of Pimmit Run.

Photinia melanocarpa (Michx.) Robertson & Phipps–*070926.51*, District of Columbia, Columbia Island, planted along edge of parking area at LBJ Memorial Grove.

**Photinia serratifolia* (Desf.) Kalkm.–*070904.53*, District of Columbia, Columbia Island, planted along parking lot at LBJ Memorial Grove.

**Prunus laurocerasus* L.–*070905.1*, District of Columbia, Columbia Island, planted in beds within LBJ Memorial Grove.

**Prunus mahaleb* L.–*s.n. W.H. Seaman* (US), District of Columbia, Theodore Roosevelt Island, historical.

**Prunus serrulata* Lindl.–*090414.1*, Arlington County, one tree planted in front of GWMP maintenance yard.

Prunus virginiana L.–*090428.5*, Arlington County, mid-level of gravel terrace woodland northwest of Arlington House, one patch 13 m diameter. This is the first known record for this species from the Coastal Plain of Virginia.

**Pyrus pyrifolia* (Burm.) F. Nakai–*070904.6*, District of Columbia, Columbia Island, planted and possibly escaped on southern end of island.

**Rhodotypos scandens* (Thunb.) Makino–*080327.3*, Arlington County, bank of Boundary Channel just south of inlet from Potomac River, a few plants. This species was also found along the GWMP at Spout Run and on Theodore Roosevelt Island.

**Rosa canina* L.–*s.n. P Bartsch* (US), 24 May 1896, Arlington County, south of Roaches Run, historical.

**Rubus laciniatus* Willd.–*090311.3*, City of Alexandria, bank of Potomac River at edge of Mt. Vernon Trail just south of Four Mile Run, a few plants

RUBIACEAE

**Cruciata pedemontana* (Bellardi) Ehrend.–*080423.6*, Fairfax County, edge of Potomac River Gorge just south of first overlook, 50-100 young plants.

Diodia virginiana L.–*060920.4*, City of Alexandria, Jones Point Park, high edge of marsh near mouth of Hunting Creek, one patch about 2 m x 3 m; also at Dyke Marsh and other low wet areas on the Coastal Plain.

Galium obtusum Bigelow–*090527.3*, Dyke Marsh, moist meadow near end of Haul Road, a few plants.

**Sherardia arvensis* L.–090520.1, Fort Hunt Park, roadside near area A, one patch 0.3 m x 0.2 m.

RUTACEAE

**Phellodendron amurense* Rupr.–*070904.2*, Fairfax County, Belle Haven, along Mount Vernon Trail just south of entrance to marina, probably planted.

**Poncirus trifolia* (L.) Raf.–*090429.7*, Fairfax County, median area between GWMP and Mt. Vernon parking lot, one tree, escaped or possibly planted.

**Skimmia japonica* Thunb.–*090629.1 R. Simmons & E. Oberg*, Arlington County, escaped in woods along southern edge of Roaches Run.

SALICACEAE
**Populus alba* L.–*090611.1*, Arlington County, edge of woodlot at Iwo Jima Memorial, two trees, escaped.

**Salix alba* L.–*080423.3*, District of Columbia, Theodore Roosevelt Island, fringe swamp on east side of island, one large tree, escaped.

Salix eriocephala Michx.–*s.n. L.F. Ward* (US), 27 April 1881, District of Columbia, Theodore Roosevelt Island, historical.

**Salix fragilis* L.–*080519.11*, Fairfax County, Dyke Marsh, edge of marsh near terminus of Haul Road, a few trees in this area.

**Salix matsudana* Koidzumi–*100728.1*, City of Alexandria, Daingerfield Island, bank of Potomac River, one tree, escaped.

Salix sericea Marsh.–*s.n. G.B. Sudworth* (US), 3 May 1889, District of Columbia, Theodore Roosevelt Island, historical.

SAPINDACEAE
**Koelreuteria paniculata* Laxm.–*070829.16*, District of Columbia, Columbia Island, bank of Boundary Channel. Planted in LBJ Memorial Grove and now escaping along bank of Boundary Channel.

SAXIFRAGACEAE
Astilbe biternata (Vent.) Britt.–*070823.2*, Fairfax County, Turkey Run Park, Potomac River floodplain south of Turkey Run, one patch about 3 m x 2 m.

Mitella diphylla L.–*060511.1*, Fairfax County, Turkey Run Park, base of slope above southern bank of Turkey Run, near mouth, five plants.

SCROPHULARIACEAE
Gratiola virginiana L.–*3707 M.T. Strong, J. Parrish, R. Simmons, & G. Zell* (US), 11 September 2006, Arlington County, tidal swamp on western side of Roaches Run Waterfowl Sanctuary.

**Kickxia elatine* (L.) Dumort.–*080825.1*, Fairfax County, Great Falls Park, low terrace of riverside outcrop barren, one plant.

**Linaria vulgaris*–*080610.11*, Arlington County, southbound GWMP roadside just north of Four Mile Run, one patch approximately 2 m x 3 m.

Mimulus ringens–*051103.2*, Fairfax County, Turkey Run Park, drought dry mouth of Turkey Run at edge of Potomac River, at least 20 plants. One plant observed in Great Falls Park on 23 July 2008 along small stream just above Potomac River south of Sandy Landing.

Nuttallanthus canadensis (L.) D.A. Sutton–*100526.1*, Fairfax County, Turkey Run Park, open slope above Potomac River near the Leiter Mansion ruins, hundreds of plants.

Penstemon digitalis (Sweet) Nutt.–*3199 R. Simmons*, 27 May 2009, City of Alexandria, Daingerfield Island, bank of remnant tidal channel and open grassy area.

Veronica americana Schwein. ex Benth–*090518.1*, Fairfax County, first stream under power line at Claude Moore Farm, approximately 12 plants.

SOLANACEAE
**Lycium chinense* P. Mill.–*1217 P. Fleming* (US), 5 August 1989, District of Columbia, Columbia Island.

**Solanum dulcamara* L.–*070829.10*, Fairfax County, GWMP roadside near Rt. 123 exit, uncommon throughout GWMP.

TILIACEAE
**Tilia cordata* P. Mill.–*080610.10*, City of Alexandria, planted in GWMP median area opposite Daingerfield Island.

THEACEAE
**Camellia japonica* L.–*090226.1*, Montgomery County, planted on east side of Clara Barton home.

ULMACEAE
Celtis laevigata Willd.–*090507.4*, City of Alexandria, Daingerfield Island, apparently planted along entrance road.

**Ulmus parvifolia* Jacq.–*070926.6*, District of Columbia, Columbia Island, crest of Potomac River shore, planted and escaping to nearby riverbank areas.

**Zelkova serrata* (Thumb.) Makino–*070725.2*, Fairfax County, Belle Haven, commonly planted in the Coastal

Plain section of the GWMP.

URTICACEAE
Parietaria pensylvanica Muhl. ex Willd.–*070829.18*, District of Columbia, Columbia Island, edge of fallow planting bed in LBJ Memorial Grove.

Pilea fontana (Lunell) Rydb.–*070926.9*, Fairfax County, Dyke Marsh, uncommon near Belle Haven Marina and along open tidal shores.

Urtica dioica L. ssp. *gracilis* (Ait.) Seland–*100715.1 with J. Parrish*, Arlington County, a few plants on floodplain between Gulf Branch and Donaldson Run.

VALERIANACEAE
**Valerianella locusta* (L.) Lat.–*080424.5*, City of Alexandria, Jones Point Park, along Mt. Vernon Trail just south of Woodrow Wilson Bridge, approximately 50 plants.

VERBENACEAE
**Vitex agnus-castus* L.–*070926.7*, District of Columbia, Columbia Island, LBJ Memorial Grove, one shrub planted or escaped under larger shrubs along parking area.

VIOLACEAE
Hybanthus concolor (T.F. Forst.) Spreng.–*s.n. J.M. Parrish*, 31 August 2006, Arlington County, forested floodplain between Windy Run and Donaldson Run.

Viola triloba Schwein. var. *dilatata* Ell. Brain.–*090429.1*, Fairfax County, edge of Mt. Vernon Trail approximately one km north of Mt. Vernon, deciduous woods near stream, rare.

VITACEAE
**Ampelopsis brevipedunculata* (Maxim.) Trautv.–*070829.13*, Arlington County, shore of Potomac River along Potomac Heritage Trail. This is an abundant invasive species throughout the Coastal Plain areas of GWMP.

MONOCOTYLEDONS

ACORACEAE
Acorus calamus L.–*070829.39*, Fairfax County, Dyke Marsh, fairly common component of the marsh.

ARACEAE
**Arum italicum* P. Mill.–*080312.1*, Fairfax County, rich woods along Potomac Heritage Trail just south of Rt. 123 exits, 12 patches along 94 m of trailside.

CYPERACEAE
Carex bromoides Schkuhr ex Willd.–*s.n. J.M. Parrish*, 25 May 2007, Arlington County, Roaches Run Waterfowl Sanctuary.

Carex comosa Boott–*080519.13*, Fairfax County, Dyke Marsh, edge of marsh along Haul Road, uncommon.

***Carex cristatella* Britt.–*1072 C. Lea* (US), 29 May 1999, District of Columbia, Theodore Roosevelt Island. This species was historically collected at Great Falls Park.

***Carex decomposita* Muhl.–*13024 A.S. Hitchcock* (US), 13 July 1917, Fairfax County, Dyke Marsh, historical.

Carex granularis Muhl. ex Willd.–*080519.10*, Fairfax County, Dyke Marsh, edge of marsh along boardwalk at end of Haul Road, fairly common at various sites near the marsh.

**Carex hirta* L.–*080424.9*, City of Alexandria, Jones Point Park, along edge of mulched trail on east side of peninsula just south of Woodrow Wilson Bridge, spreading over 10 m of woodland edge.

Carex hitchcockiana Dewey–*090505.6*, Fairfax County, Turkey Run Park, edge of Potomac Heritage Trail on Potomac River floodplain north of Turkey Run, seven tufts.

***Carex lacustris* Willd.–*s.n. C.L. Pollard* (US), 25 May 1899, Dyke Marsh, Fairfax County. *s.n. P. Bartsch* (US), 24 May 1896, Arlington County, Roaches Run, historical.

Carex molesta Mackenzie ex Bright–*090527.5*, Fairfax County, Dyke Marsh, mesic meadow along Haul Road near apex of peninsula, at least 100 plants over 0.1 ha.

Carex oligocarpa Schk. Ex Willd.–*1456 C. Lea* (GMUF), 6 May 2000, Fairfax County, Turkey Run Park, Potomac River floodplain just north of Turkey Run.

***Carex pallescens* L.–*s.n. T. Holm* (US), 27 May 1893, Arlington County, Potomac shore near Aqueduct Bridge (present-day Key Bridge), historical.

Carex stipata Muhl. ex Willd.–*080519.30*, District of Columbia, Theodore Roosevelt Island, tidal fringe swamp near bridge to island, common; also observed at Dyke Marsh.

Carex stipata Muhl. ex Willd. var. *maxima* Chapman–*1080 C. Lea* (US), 29 May 1999, District of Columbia, Theodore Roosevelt Island, swamp trail.

**Carex texensis* (Torr.) Bailey–*090507.5*, moist roadside ditch along southbound GWMP opposite Daingerfield Island, a few tufts.

**Cyperus difformis* L.–*080724.2*, City of Alexandria, Daingerfield Island, low wet area of turf grass at south end of soccer field, 11 plants.

Cyperus lupulinus (Spreng.) Marcks–*080731.1*, Fairfax County, Fort Hunt Park, open disturbed area on World War II battery, abundant at one site.

Eleocharis engelmannii Steud.–*080618.5*, City of Alexandria, Daingerfield Island, edge of swamp north of boardwalk.

***Schoenoplectus fluviatilis* (Torr.) M.T. Strong–*080519.25*, Fairfax County, Dyke Marsh, Hog Gut, fairly common throughout marsh. This species is also present in a remnant marsh at Jones Point in the City of Alexandria and at Roaches Run Waterfowl Sanctuary in Arlington County.

IRIDACEAE

**Crocus vernus* (L.) Hill–*090318.1*, Fairfax County, escaped along southern terminus of Mt. Vernon Trail, 13 plants.

**Iris pseudacorus* L.–*080519.2*, Fairfax County, Dyke Marsh, uncommon along edge of marsh. This iris is also present in the marsh on Theodore Roosevelt Island in the District of Columbia.

JUNCACEAE

Juncus debilis Gray–*090527.8*, Dyke Marsh, gravely tidal shore of Potomac River on southern side of Haul Road peninsula, hundreds of plants.

Juncus diffusissimus Buckl.–*080618.3*, City of Alexandria, Daingerfield Island, edge of wetland just north of boardwalk, one tuft with approximately 50 fruiting culms.

LILIACEAE

**Galanthus nivalis* L.–*080410.2*, Fairfax County, woods northwest of Mt. Vernon, persisting and evidently spreading at old home site. This species was also observed along the northern bank of Pimmit Run near the GWMP.

**Hosta ventricosa* (Salisb.) Stearn–*080626.1*, Fairfax County, Turkey Run Park, rich woods along bank of Turkey Run about 200 m from GWMP.

**Hyacinthus orientalis* L.–*080401.2*, Fairfax County, Turkey Run Park, escaped in yard behind Resource Management Building.

**Liriope muscari* (Dcne.) Bailey–*070910.1*, Arlington County, along Potomac Heritage trail on bank of Potomac River just north of Theodore Roosevelt Island, well established escape.

**Liriope spicatum* Lour.–*090730.1*, Fairfax County, well established in woods west of Claude Moore Farm and north of Langley Fork Park.

**Narcissus poeticus* L.–*080403.3*, District of Columbia, Columbia Island, escaped along bank of Boundary Channel.

**Trillium luteum* (Muhl.) Harbison–*090421.2*, Fairfax County, rich deciduous woodland along Potomac Heritage Trail approximately 1 km north of Ft. Marcy, 5 plants, 3 flowering.

NAJADACEAE

**Najas minor* All.–*070926.10*, Fairfax County, Dyke Marsh, an abundant and invasive aquatic species in bays of Dyke Marsh.

Najas guadalupensis (Spreng.) Magnus–*070926.12*, Fairfax County, Dyke Marsh, an uncommon to rare aquatic species in bays of Dyke Marsh.

ORCHIDACEAE

**Epipactis helleborine* (L.) Crantz–*080811.1*, Fairfax County, Potomac River Gorge, rich woods on slope of Potomac River just north of Pimmit Run. *090624.1*, Montgomery County, Glen Echo, bank of Minnehaha Creek.

Spiranthes ovalis Lindl. var. *erostellata* Catling–*091005.2 with J. Parrish*, Turkey Run Park, Tulip Popular woodland south of GWMP, at least 100 plants. Smaller populations occur on the north side of the GWMP near the NPS headquarters buildings.

POACEAE

**Agrostis gigantea* Roth.–*400 R. Kanal* (US), 24 June 1989, District of Columbia, Columbia Island.

**Aira caryophyllea* L.–*080522.1*, Fairfax County, southbound GWMP roadside just south of Collingwood exit, hundreds of plants.

Alopecurus carolinianus Walt.–*080519.17*, Fairfax County, Dyke Marsh, wet ditch along Mt. Vernon Trail, hundreds of plants.

Arundinaria gigantea (Walt.) Muhl. ssp. *tecta* (Walt.) McClure–*080305.1*, Fairfax County, bank of Dead Run, one patch 10 m x 10 m.

**Bromus commutatus* Schrad.–*080519.31*, District of Columbia, Theodore Roosevelt Island, large patch on southern tip of island; also historically recorded from Great Falls Park.

**Bromus inermis* Leyss.–*080610.1*, Montgomery County, Clara Barton Parkway southbound roadside at pumping station, a few plants.

**Bromus racemosus* L.–*224 R. Kanal* (US), 21 May 1988, District of Columbia, Columbia Island.

**Bromus sterilis* L.–*348 R. Kanal* (US), 29 May 1989, District of Columbia, Columbia Island.

**Bromus tectorum* L.–*080423.4*, GWMP roadside along edge of Potomac River Gorge just south of overlook one, thousands of plants.

**Elymus repens* (L.) Gould–*080610.3*, District of Columbia, Columbia Island, bank of Potomac River, uncommon.

Hordeum pusillum Nutt.–*080519.16*, Fairfax County, GWMP roadside at Dyke Marsh, about 50 plants.

Leptochloa fusca (L.) Kunth ssp. *fascicularis* (Lam.) N. Snow–*070829.21*, City of Alexandria, Daingerfield Island, wet depression in turf grass and at edge of swamp, hundreds of plants.

**Oplismenus hirtellus* (L.) Beauv. ssp. *undulatifolius* (Ard.) U. Scholz–*080915.2*, Fairfax County, Great Falls Park, rich woods on slope above maintenance building. This population has been targeted as part of an active eradication program.

**Paspalum dilatatum* Poir.–*061011.1*, Arlington County, GWMP roadside near Memorial Avenue, at least 15 plants.

Paspalum laeve Michx.–*070829.36*, City of Alexandria, Jones Point Park, turf grass near wooded edge of tidal Potomac shore, fairly common.

Paspalum setaceum Michx.–*070829.28*, City of Alexandria, Daingerfield Island, turf grass near edge of wetland, fairly common.

**Pennisetum alopecuroides* (L.) Spreng.–*101003.1*, Fairfax County, Dyke Marsh, well established along Haul Road.

**Phleum pratense* L.–*080918.3*, Arlington County, bank of Potomac River opposite southern end of Theodore Roosevelt Island, surprisingly rare in GWMP.

**Phragmites australis* (Cav.) Trin. Ex Steud. ssp. australis–*070829.33*, City of Alexandria, Daingerfield Island; also at Dyke Marsh and Roaches Run, slowly being eradicated from these sites by herbicide treatments.

**Phyllostachys aurea* Carr. Ex A.&C. Riviere–*080327.6*, Fairfax County, southbound GWMP roadside at Cigarette Turnaround, large patch vigorously spreading, probably planted somewhere upslope.

**Phyllostachys aureosulcata* McClure–*080414.1*, Montgomery County, probably planted and now vigorously spreading over large area behind Clara Barton house.

**Phyllostachys nigra* (Lodd.) Munro var. *henionis* (Mitf.) Stapf ex Rendle–*080407.1*, Fairfax County, southbound GWMP roadside near overlooks, large patch vigorously spreading, planted by adjacent land owner.

**Pseudosasa japonica* (Sieb. & Zucc. ex Steud.) Makino ex Nakai–*080403.2*, Fairfax County, southbound GWMP opposite Dyke Marsh, at least two sites with hundreds of stems, probably spreading from plantings near this area.

**Setaria pumila* (Poir.) Roemer & J.A. Schultes–*420 R. Kanal* (US), 2 October 1991, District of Columbia, Columbia Island.

**Vulpia myuros* (L.) K.C. Gmel.–*080519.19*, Fairfax County, GWMP roadside near Little Hunting Creek, thousands of plants.

Zizania aquatica L.–*070829.25*, Fairfax County, Dyke Marsh, common but patchy throughout.

PONTEDERIACEAE
Heteranthera reniformis Ruiz & Pavon–*s.n., J.M. Parrish*, 3 November 2007, Arlington County, mudflat along Potomac River opposite southern end of Theodore Roosevelt Island.

Pontederia cordata L.–*070829.27*, Fairfax County, Dyke Marsh, fairly common along edges of tidal channels in marsh; listed as historical at Great Falls Park.

SPARGANIACEAE
Sparganium eurycarpum Engelm.–*080519.7*, Fairfax County, Dyke Marsh, along boardwalk at end of Haul Road, rare.

TYPHACEAE
Typha angustifolia L.– *080527.9*, Fairfax County, Dyke Marsh, the dominant species in the marsh; also historically recorded at Great Falls Park.

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Timber Harvesting Effects on Small Terrestrial Vertebrates and Invertebrates on Grassy Hill Natural Area Preserve, Franklin County, Virginia

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ABSTRACT

We captured small terrestrial vertebrates and invertebrates using live traps at the Grassy Hill Natural Area Preserve near Rocky Mount, Virginia to compare their abundance and species composition in an area where a timber harvest was conducted to restore open woodland habitat for rare plant species with that of an adjacent unharvested forest tract. In general, we captured few species of vertebrates on the site, but large numbers of invertebrates were captured in pitfall traps. Amphibian captures were significantly higher on the unharvested tract, mostly due to larger numbers of juvenile American Toads (*Anaxyrus americanus*). Captures were also higher on the unharvested site for most invertebrate orders. Small mammal captures also tended to be higher in the unharvested tract, but not significantly. Reptile captures were similar for the harvested and unharvested tracts. In the short-term, most groups of vertebrate and invertebrate animals had lower captures on the harvested site compared to the unharvested control site.

Key words: Timber harvesting, amphibians, small mammals, reptiles, invertebrates.

INTRODUCTION

Timber harvesting is typically conducted to obtain wood products, but can also be used as a tool for ecological restoration (Elliott & Hewitt, 1997; Fuller et al., 2004). The Virginia Department of Conservation and Recreation (DCR) is currently using single tree selection timber harvesting to restore open woodland communities on the Grassy Hill Natural Area Preserve in Franklin County, Virginia. A combination of dry, mafic soils along with fire as a natural and anthropogenic disturbance agent resulted in the formation of grass-dominated plant communities along with scattered trees, predominantly oak species (*Quercus* spp.) (DCR 2010). With the suppression of fire, most of Grassy Hill has been converted to closed forest, reducing habitat for some rare plant species, including the federally endangered Smooth Coneflower (*Echinacea laevigata*). DCR is currently using timber harvesting to open the forest canopy on the preserve along with prescribed fire to restore open woodland communities.

Timber harvesting affects wildlife populations by modifying habitat conditions. DCR is interested in understanding how the restoration treatments will affect species of small vertebrates and invertebrates. Small vertebrate populations represent an important biotic component in forests because of their abundance and role in community and ecosystem processes. For example, they serve as a prey base for larger animals and may also be important predators of invertebrates (Buckner, 1966; Burton & Likens, 1975; Sullivan, 1990). Small mammals are also important dispersers of seeds and fungal spores and play an important role in the turnover of organic matter (Stoddart, 1979). Many amphibian species are sensitive to environmental changes and are useful for monitoring ecosystem integrity (Welsh & Droege, 2001). Invertebrates also play important roles in forest ecosystems, serving as detritivores, herbivores, pollinators, predators, and prey items (Rosenberg et al., 1984; Wilson, 1987), but much less is known about them than vertebrates, particularly their response to timber harvesting.

We tested the hypothesis that timber harvesting of mature forest would affect the abundance, species composition, and species diversity of small vertebrate communities compared to an untreated forest on the Grassy Hill Natural Area Preserve in Franklin County, Virginia. This information should help DCR determine the effects of this habitat management technique on small vertebrate communities. A prescribed burn was also planned for the timber harvested area prior to our study, but it was not conducted due to logistical issues and unfavorable weather conditions.

METHODS

Site Description

Grassy Hill Natural Area Preserve is located in Franklin County, Virginia, just west of the town of Rocky Mount. The Preserve was created in 1992 with the support of The Nature Conservancy and is managed by the Virginia Department of Conservation and Recreation. The Preserve includes approximately 1,440 acres and contains forests dominated by oak and hickory, Piedmont basic woodlands, and small remnants of Piedmont prairie. Soils are shallow, basic, and clayey and are derived from magnesium-rich bedrock.

The study area was within Unit 1 of the Preserve located on the western edge of Rocky Mount, on the lower eastern slopes of Grassy Hill, at about 400 m in elevation (Fig. 1). A 55-acre tract within this unit was harvested in the spring of 2009. The goal of this harvest was to accelerate restoration and expansion of open woodland and Piedmont prairie communities, portions of which are probable Smooth Coneflower (*Echinacea laevigata*) habitat. The combination of timber harvesting followed by prescribed burning would alter forest structure and species composition to a condition that would resemble that of forests on this site when they were under the regular influence of fire. The subsequent reduction in forest floor litter and duff, coupled with increased solar radiation on the forest floor, is expected to stimulate seed germination and grass/forb production.

We conducted a systematic sample of the density and basal area of tree species within the harvested tract and an adjacent unharvested tract after harvesting in September 2009. From a random starting point near one corner of the harvested area, we located ten 0.4 ha circular plots in a grid with each point separated by 50 m. All live trees >10 cm diameter-at-breast height were measured. Similarly, we sampled the adjacent unharvested tract. The harvested tract had approximately one-half the basal area and one-third of the tree density as the unharvested tract (Table 1). White Oak (*Quercus alba*) had the highest density and basal area in each tract and the species occurring in each tract were generally similar, although the proportions differed (Table 1). Most notably, Post Oak (*Quercus stellata*) was the second most abundant species on the harvested tract and had twice the density there compared to the unharvested tract. There were some topographic differences between the harvested and unharvested areas. The border of the two tracts met on a side slope with the unharvested area towards the upper slope, continuing over a low ridge to the other side down to a toe slope position (Fig. 1).

Sampling

From June-September 2010, we sampled small vertebrates and invertebrates within adjacent harvested and unharvested areas. Two different sampling methods were employed with equal effort among the two treated areas including live trapping for small mammals and pitfall trapping for small mammals, reptiles, amphibians, and invertebrates. Trapping was conducted under the specifications set by the Virginia Department of Game and Inland Fisheries scientific collection permit #38636 granted to Todd Fredericksen. All sampling was conducted at least 50 m from treatment borders to minimize edge effects.

We conducted pitfall trapping using a drift fence-pitfall trap design that has been highly successful in capturing small vertebrates at a nearby location (Fredericksen et al., 2010). In each treatment, three drift fence-pitfall arrays were established with each array in a treatment located at least 50 m apart. Each array was in the shape of a "+". At the center of each array, a 20 l plastic bucket was buried flush with the ground level. Woven plastic silt fence supported by wooded stakes was then placed in the four cardinal directions 5 m out from the central bucket with the bottom of the fence buried in the ground. At the terminus of each drift fence segment, another bucket was installed in the ground. The lid of each bucket was supported by wooden stakes approximately 25 cm above the bucket to reduce rainfall entry and provide shade for captured animals. Holes were drilled in the bottom of the buckets to facilitate water drainage. Traps were installed in early June and checked daily, except for some weekends and holidays when the traps were closed if no one was available to check them. The total number of trap-nights per treatment equaled 540 (15 buckets x 36 nights opened). Every morning, the number of captured vertebrates per species was recorded for each trap and animals were released just outside of and facing away from the pitfall trapping area. Released animals were not marked. Invertebrate species were similarly counted at the order level and then released outside of the trapping area.

Live trapping for mammals was also conducted using Sherman live traps. Twenty-five 30 x 9 cm

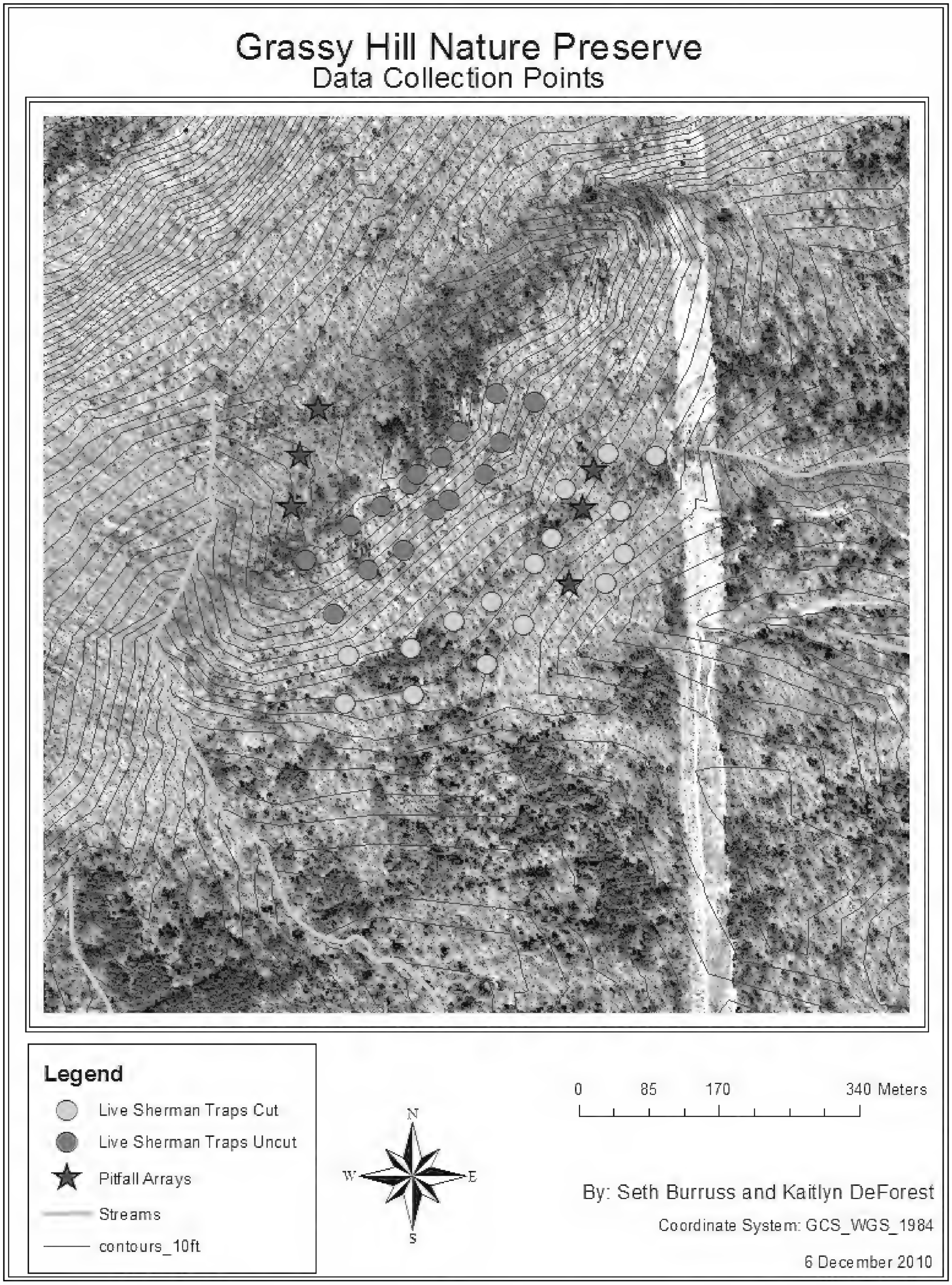

Fig. 1. Map of Grassy Hill Natural Area Preserve study area and sampling locations.

Table 1. Density and basal area of trees > 10 cm diameter-at-breast height in harvested and unharvested areas of Grassy Hill Natural Area Preserve based on ten 0.4 ha circular plots in each area.

Harvested Area

Common name	**Species name**	**Density (trees/ha)**	**Basal area (m^2/ha)**
White Oak	*Quercus alba*	53.8	5.40
Post Oak	*Quercus stellata*	43.7	1.82
Pignut Hickory	*Carya glabra*	19.3	0.92
Black Oak	*Quercus velutina*	4.1	0.22
Blackjack Oak	*Quercus marylandica*	3.0	0.21
Sourwood	*Oxydendrum arboreum*	2.0	0.01
Blackgum	*Nyssa sylvatica*	1.0	0.02
Virginia Pine	*Pinus virginiana*	1.0	0.05
Cucumbertree	*Magnolia acuminata*	1.0	0.02
Shortleaf Pine	*Pinus echinata*	1.0	0.18
TOTAL		**129.9**	**8.85**

Unharvested Area

Common name	**Species name**	**Density (trees/ha)**	**Basal area (m^2/ha)**
White Oak	*Quercus alba*	163.3	10.18
Pignut Hickory	*Carya glabra*	61.6	1.13
Virginia Pine	*Pinus virginiana*	59.3	3.69
Post Oak	*Quercus stellata*	23.3	0.72
Red Maple	*Acer rubrum*	23.3	0.44
Chestnut Oak	*Quercus montana*	12.7	0.44
Mockernut Hickory	*Quercus alba*	8.5	0.25
Tuliptree	*Liriodendron tulipifera*	8.5	1.44
Blackgum	*Nyssa sylvatica*	6.4	0.27
Blackjack Oak	*Quercus marylandica*	6.4	0.21
Black Oak	*Quercus velutina*	2.1	0.06
TOTAL		**375.4**	**18.83**

Table 2. Amphibian captures for three pitfall arrays in harvested and unharvested tracts from June-September 2010 on Grassy Hill Natural Area Preserve, Rocky Mount, Virginia.

Species	**Harvested**	**Unharvested**
American Toad (*Anaxyrus americanus*)	67	108
Wood Frog (*Lithobates sylvaticus*)	1	3
TOTAL	**68**	**111**

aluminum traps were set out in a grid within each treatment area. The grid consisted of eight sites located 25 m apart with each site having three or four traps baited with peanut butter and oatmeal. Trapping occurred simultaneously in all treatments for four consecutive days during nine weeks from June-August for 900 trap-nights (36 nights x 25 traps). Mammals were ear-tagged and released.

Data Analysis

When there was a sufficient number of captures to compare, we used a chi-square analysis to test for differences in captures between the harvested and unharvested tracts for individual species or species groups. Statistical analyses were performed using SYSTAT 12.2 (SYSTAT Software, Inc., San Jose, CA).

RESULTS

A total of 2,441 captures of vertebrates and invertebrates was recorded over the four-month period, including 45 mammals, 179 amphibians, and 20 reptiles. The majority of captures were invertebrates (n = 2197). Overall, we found higher numbers of both vertebrates and invertebrates in the unharvested tract. Capture rates tended to be higher following rainfall events for all taxonomic groups.

Amphibians represented 73% of the vertebrate captures, nearly all of which were metamorphs or otherwise juvenile American Toads (*Anaxyrus americanus*) (Table 2). The only other amphibian species captured was the Wood Frog (*Lithobates sylvaticus*). Of the 179 amphibians captured, 111 were recorded in the unharvested forest stand compared to 68 in the harvested stand (χ^2=5.23, p = 0.02) (Table 2).

Mammals represented 18% of total vertebrate captures and consisted primarily of White-footed Mice (*Peromyscus leucopus*) (54%) and shrews (Soricidae) (44%). Excluding recaptures, seven White-footed Mice were captured in the harvested stand and 17 in the unharvested stand, all but one of which were taken in Sherman traps (χ^2=2.17, p = 0.14). Shrews were also captured more often in the unharvested compared to the harvested tract (14 vs. 6) (χ^2=1.67, p = 0.20) (Table 3).

Reptiles comprised 9% of the total vertebrate captures, the most numerous of which was the Eastern Fence-Lizard (*Sceloporus undulatus*), which made up 60% of all reptiles captured (Table 4). There was a similar number of captures of this species in both harvested and unharvested tracts. The Common Five-lined Skink (*Plestiodon fasciatus*) represented 25% of the reptile captures and had four times more captures in the unharvested stand than in the harvested stand. Smooth Earthsnake (*Virginia valeriae*) and Wormsnake (*Carphophis amoenus*) were also captured in lower numbers with relatively even distribution among the two tracts.

Invertebrates of nine orders were captured in the pitfalls arrays (Table 5) with nearly double the number of captures in the unharvested tract compared to the harvested one (χ^2=95.50, p<0.001). Beetles (Coleoptera) accounted for 40% of the invertebrate captures, with significantly higher numbers in the unharvested tract (χ^2=4.10, p = 0.04). Spiders (Araneae) were the second most abundant invertebrate order, comprising 23% of the captures, with significantly higher numbers in the unharvested tract (χ^2=10.03, p = 0.002). The remaining invertebrate orders in decreasing capture frequencies were: Orthoptera 17% (crickets), Spirobolida 8% (millipedes), Blattodea 7% (roaches), Lepidoptera 3% (larvae of moths and butterflies), Heteroptera 1% (true bugs), Geophilomorpha 0.8 % (centipede), and Polydesmida 0.7% (flat millipede). All of these orders except Lepidoptera had significantly (p<0.05) more captures on the unharvested tract, whereas Lepidoptera larvae were captured significantly more often on the harvested tract (χ^2=10.12, p = 0.001).

DISCUSSION

Timber harvesting, especially intensive harvesting such as clearcutting, dramatically changes environmental conditions, species composition, and vegetative structure within forests (Chen et al., 1999; Zheng et al., 2000). Not all species, however, are negatively affected by these changes. Wildlife species react differently to the variety of habitat modifications caused by timber harvesting, including decreased overstory cover, increased ground vegetation cover, increased downed coarse woody debris, and changes in the abundance of food resources (DeCalesta, 1989; Healy, 1989). For example, on privately-owned woodlots in Virginia, timber harvesting significantly increased the abundance and species richness of small mammals and reptiles (Fredericksen et al., 2006; Shively et al., 2006), but resulted in a decrease in the abundance of some salamander species (Fredericksen et al., 2006).

In this study, we captured more small terrestrial vertebrates and invertebrates in the unharvested tract than the harvested forest, although the differences were not statistically significant for all groups. This result differs from those of other studies of timber harvesting conducted in Franklin County (Fredericksen et al., 2006; Shively et al., 2006) where small mammals and reptiles tended to be more abundant on harvested sites compared to unharvested ones, while captures of

Table 3. Mammal captures for three pitfall arrays in harvested and unharvested tracts from June-September 2010 on Grassy Hill Natural Area Preserve, Rocky Mount, Virginia.

Species	**Harvested**	**Unharvested**
Masked Shrew (*Sorex cinereus*)	3	9
Smokey Shrew (*Sorex fumeus*)	3	5
Red-backed Vole (*Myodes gapperi*)	1	0
TOTAL	**7**	**14**

Table 4. Reptile captures for three pitfall arrays in harvested and unharvested tracts from June-September 2010 on Grassy Hill Natural Area Preserve, Rocky Mount, Virginia.

Species	**Harvested**	**Unharvested**
Eastern Fence-Lizard (*Sceloporus undulatus*)	6	6
Common Five-Lined Skink (*Plestiodon fasciatus*)	1	4
Smooth Earthsnake (*Virginia valeriae*)	1	0
Wormsnake (*Carphophis amoenus*)	1	1
TOTAL	**9**	**11**

Table 5. Invertebrate captures by order for three pitfall arrays in harvested and unharvested tracts from June-September 2010 on Grassy Hill Natural Area Preserve, Rocky Mount, Virginia.

Taxonomic Group (Order)	**Harvested**	**Unharvested**
Geophilomorpha (Centipedes)	5	14
Spirobolida (Millipedes)	31	138
Polydesmida (Millipedes)	3	15
Araneae (Spiders)	206	307
Heteroptera (True bugs)	4	25
Coleoptera (Beetles)	399	484
Orthoptera (Crickets)	70	315
Blattodea (Roaches)	30	116
Lepidoptera (Moth and butterfly larvae)	30	5
TOTAL	**788**	**1419**

amphibians tended to be similar. This study is limited in that it occurred only on one site with pseudoreplicated data and examined the effects of harvesting after only one year. Further sampling may be conducted at this site in future years in order to determine longer-term effects. This study may also serve as a baseline for determining the effects of prescribed fire to these stands, if this treatment is implemented at this site.

The large number of juvenile toads captured on the study site may be due to the dispersal of these animals during this time of year from breeding locations somewhere on or near Grassy Hill. While toads have been shown to tolerate the desiccating conditions in harvested areas better than other amphibians (Rittenhouse et al., 2008), it has been observed that migrating juvenile amphibians generally avoid areas without canopy cover (Patrick et al., 2006; Semlitsch et al., 2008). In addition, although it is uncertain where the natal habitat of the juvenile toads was located, the unharvested tract is closer to a permanent drainage than the harvested one, suggesting that captures were more likely in the former area. Wood Frogs prefer to breed in vernal pools in closed forests (Skelly et al., 2002), which may explain the higher number of captures in the unharvested tract.

Small mammals had higher capture rates in the unharvested stand, consisting mostly of White-footed Mice and shrews. These results contrast with those of Shively et al. (2006), who found a three-fold greater abundance of small mammals on timber-harvested sites compared to unharvested sites in Franklin County. The higher capture rate of shrews on unharvested areas in our study may be due to the higher moisture requirements of these species (Kirkland, 1990). Several studies have observed, however, that shrew populations are not affected greatly by changes in forest overstory cover (Ford & Rodrigue, 2001; Greenberg & Miller, 2004; Matthews et al., 2009), although Greenberg et al. (2007) found that high intensity disturbance to the forest canopy can negatively affect shrews. Part of the unharvested tract appeared to have more exposed rock crevices, which perhaps supported more cover habitat to support larger small mammal populations. The dry, exposed location of Grassy Hill may also make harvested locations less suitable than those on moister sites.

Reptiles are more adapted to higher temperatures and lower moisture levels that are characteristic of harvested tracts. However, reptile captures were similar on harvested and unharvested tracts and more Common Five-lined Skinks were found on the unharvested tract. In selectively-logged hardwood forests, Ross et al. (2000) and Fredericksen et al. (2006) found a higher abundance of snakes and lizards in logged stands compared to unlogged hardwood stands, attributing this to the greater availability of areas for basking and greater quantities of downed coarse woody debris. Food availability for small snakes and lizards, however, appeared to be higher in the unharvested tract at Grassy Hill given the larger number of captures of invertebrates there compared to the harvested tract.

With the exception of Lepidoptera, all orders of invertebrates had higher captures in the unharvested tract. Time since logging may be a factor explaining the higher invertebrate species observed on the unharvested tract in this study. Species of invertebrates vary widely with respect to habitat requirements, ranging from open environments, such as those associated with logging, and closed canopy forest conditions (Werner & Raffa, 2000; Pearce & Venier, 2006). Following logging, species composition gradually changes from a dominance of forest species to open habitat species (Niemelä et al., 1993; Pearce & Venier, 2006). Immediately after logging, forest species are likely to be in decline, but open habitat species are perhaps only beginning to colonize the harvested tract. In addition, habitat structural features that may be enhanced by logging may take time to become suitable for invertebrates. For example, logging in hardwood forests generally increases the amount of coarse woody debris on the forest floor (Shively et al., 2006), which was the case for the harvested tract in this study. Until it decays, however, it may not be useful for overwintering or oviposition sites for many species of invertebrates (Pearce & Venier, 2006). Similarly, studies have shown that invertebrates often have a higher abundance in grassy openings compared to adjacent closed forests due to increased amounts of herbaceous cover (Martin & McGinnes, 1975; Healy, 1985). The herbaceous vegetation on the harvested tract was still in the process of becoming established, as evidenced by a significant amount of bare soil present on this site. As vegetation establishment continues, invertebrate populations are likely to increase. With continued monitoring of these sites in future years and further detailed taxonomic discrimination, we hope to understand longer-term impacts of harvesting on invertebrate abundance and species composition at Grassy Hill.

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Two Austral Dung Beetles New to the Virginia Fauna (Coleoptera: Scarabaeidae)

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ABSTRACT

The dung beetles *Phanaeus igneus* MacLeay and *Copris howdeni* Matthews & Halffter are reported from Virginia for the first time, representing northern range extensions from North Carolina and South Carolina, respectively. Both species were collected in remnant xeric pine-scrub oak sandhill communities, a rare habitat type in Virginia. Data also are provided on the distribution of all other members of both genera that occur in Virginia.

Key words: *Copris*, *Phanaeus*, Scarabaeidae, pine-scrub oak sandhill, Virginia.

Pitfall trapping is a proven technique for capturing terrestrial arthropods, particularly beetles and spiders. Employment of this sampling method by staff of the Virginia Department of Conservation and Recreation, Division of Natural Heritage (DNH) and the Virginia Museum of Natural History (VMNH) during the past two decades has yielded many new state records, even taxa new to science (e.g., Henry, 1993; Anderson et al., 1995; Hoffman, 2005, 2010). Herein we add two dung beetles (*Phanaeus igneus* MacLeay and *Copris howdeni* Matthews & Halffter) to the Virginia faunal list based on recent collections made by DNH staff in rare xeric pine-scrub oak sandhill habitats in the southeastern portion of the state, where both species reach their northernmost known range limits.

Phanaeus MacLeay

Phanaeus is a large genus of approximately 50 medium to large-sized (up to 25 mm in length) dung beetle species that occurs throughout the New World from the United States south to northern Argentina (Edmonds, 1994; Price, 2007, 2009). The members of this genus are well-known for their bright metallic coloration and pronounced sexual dimorphism. They have attracted the interest of collectors, taxonomists, and ecologists for well over a century, and have been the subjects of numerous studies documenting male-male competition (the males of some species possess enormous horns), bisexual cooperation (both sexes provision the nesting gallery), and nesting behavior (Price & May, 2009). Most species of *Phanaeus* are coprophagous, exploiting the fresh excrement of large herbivores and omnivores, and their nesting behavior (nidification) is characterized mainly by tunneling rather than the rolling behavior exhibited by other dung beetles (Price & May, 2009).

Phanaeus igneus MacLeay is a medium-sized, brilliantly colored dung beetle. The name *igneus* “firey” was bestowed to denote the metallic red color of the forebody (head and thorax) in (some but not all) males. The elytra are metallic green (or occasionally red). Some specimens are dark blue to black. The known range of this austral species extends from easternmost Louisiana and southern Florida (exclusive of the Keys) north to New Bern, Faison, and Southern Pines, North Carolina (Edmonds, 1994). The discovery of *P. igneus* in southeastern Virginia is documented by two series of specimens taken by pitfall trapping:

Sussex Co.: Chub Sandhill Natural Area Preserve, burn unit #3 pitfall traps, 9 August 2002, C. Young (VMNH, 20). *City of Suffolk*: South Quay Pine Barrens, ca. 6 mi [10 km] SSE Franklin, 100 m N of canal, 1 July-5 August 2003, pitfall traps, S. M. Roble (VMNH, 15); same site, pitfall traps, 27 October 2005, S. M. Roble (VMNH, 5).

These records extend the known range of *P. igneus* approximately 200 km (125 mi) north of the New Bern, North Carolina locality.

Two other species of *Phanaeus* inhabit Virginia. Edmonds (1994) recorded *P. triangularis triangularis* (Say) from Jones Creek. This locality in Lee County in far southwestern Virginia was visited in the late 19th century by Henry G. Hubbard and Eugene A. Schwarz, two well-known entomologists who presumably made the collection. Surveys by DNH and VMNH staff throughout the state have not yielded additional specimens of this species and we are not aware of any Virginia collections obtained during the past century. Brimley (1938) cited records for *P. triangularis* in North Carolina as far north as Chapel Hill.

Phanaeus vindex MacLeay is typically metallic green and purple and closely related to *P. igneus* (Edmonds, 1994; Price, 2005). Dark blue to black specimens are rare. “Major” (large) males of *P. vindex* possess a substantial, elongate, recurved “horn” whereas *P. igneus* males have a shorter, straight horn (Edmonds, 1994). *Phanaeus vindex* is rather widely distributed in eastern and central United States south of 43°N latitude. Edmonds (1994) cited Virginia records (collected March-September) from 13 localities that fall within the following jurisdictions: Albemarle, Augusta [or Nelson], Bath, Campbell, Caroline, Dinwiddie, Fairfax, Grayson, Montgomery, Prince Edward, and Washington counties, and the cities of Suffolk and Virginia Beach. VMNH has records for Caroline, Henrico, Isle of Wight, King George, Mecklenburg, Montgomery, Nottoway, Pulaski, Rockingham, and York counties, and the City of Suffolk. SMR has also seen a live male from Prince William County.

Copris Geoffroy

Copris howdeni Matthews & Halffter is a poorly known, relatively large dung beetle that was originally described from Florida in 1959 (Matthews & Halffter, 1959; Matthews, 1961). Woodruff (1973) and Woodruff & Deyrup (1994) reported that it was very rare and apparently endemic to Florida, with confirmed records from only six counties in the southern half of that state, ranging from the central peninsula area (e.g., Highlands, Osceola, and Manatee counties) to Big Pine Key in the Florida Keys. Woodruff & Deyrup (1994) noted that the largest series of specimens was from the island site, and stated that repeated efforts to obtain more material at all other known sites had been unsuccessful. They described *C. howdeni* as a “particularly mysterious beetle” that is “almost never seen.” Its habitat, habits, and hosts are unknown, although Woodruff & Deyrup (1994) concluded that it is presumably a dung feeder, though likely not confined to a particular vertebrate host. Previously, Woodruff (1982) had speculated that *C. howdeni* was “probably associated with dung of some rare vertebrate.” He also recommended it for “Threatened” status in Florida. Harpootlian (2001) cited published records of this species from two counties in South Carolina that were obtained several decades earlier (and thus apparently overlooked by Woodruff & Deyrup [1994]) and noted a questionable record from Georgia.

The occurrence of *C. howdeni* in Virginia is documented by a series of 14 specimens (all deposited in VMNH) obtained at one of the two collection sites reported above for *P. igneus*:

City of Suffolk: South Quay Pine Barrens, ca. 6 mi [10 km] SSE Franklin, 100 m N of canal, 4 September 2002, uv, S. M. Roble and C. S. Hobson (1), 24 October-12 November 2002, pitfall trap, S. M. Roble (1), 4 April 2003, pitfall traps, S. M. Roble and A. C. Chazal (3), 6 August-16 September 2003, pitfall traps, S. M. Roble (3), 16 September-5 November 2003, pitfall trap, S. M. Roble (1), 4 November 2003, [uv?], S. M. Roble (2), 24 May 2004, uv, S. M. Roble (1); South Quay Pine Barrens, Area 52: 16 September-5 November 2003, pitfall trap (xeric site), S. M. Roble (1), 23 June 2003, uv (mesic site), S. M. Roble (1).

This record extends the known range of *C. howdeni* approximately 420 km (260 miles) north from McClellanville, South Carolina.

Two other members of the genus *Copris* have been recorded from Virginia. VMNH specimens were collected in the following political units:

Copris fricator (Fabricius): Alleghany, Augusta, Botetourt, Dickenson, Franklin, Halifax, Lee, Montgomery, Pulaski, Scott, Washington, and Wise counties, defining a basically western distribution in the state, at least at low to moderate elevations.

Copris minutus (Drury): Accomack, Caroline, Charles City, Cumberland, Dinwiddie, Fluvanna, Franklin, Greensville, Henrico, Henry, Isle of Wight, King George, Mecklenburg, Montgomery, Northampton, Prince William, Pulaski, Roanoke, Sussex, York, Washington, Westmoreland, and Wise counties, and the cities of Chesapeake, Suffolk, and Virginia Beach. The great majority of these sites lie east of the Blue Ridge.

Habitats

Chub Sandhill Natural Area Preserve borders the Nottoway River for more than 3 miles (5 km). It was established in 1995 by the Virginia Department of Conservation and Recreation, Division of Natural Heritage, and is owned and managed by that agency. The property was once the shore of an ancient estuary and now contains deep, sandy soils that support a remnant pine-scrub oak sandhill community dominated by loblolly pine (*Pinus taeda* L.) and southern red oak (*Quercus falcata* Michaux) (VDCR, 2006, 2010). A recent addition has nearly doubled the size of Chub Sandhill Natural Area Preserve to 1066 acres (431 ha). Current management efforts at the preserve include prescribed burning to restore the much reduced fire-maintained natural communities as well as extensive planting of longleaf pine (*Pinus palustris* Miller) seedlings in an effort to return this once-dominant tree to the area.

The South Quay pine barrens is another unique habitat in Virginia that is also worthy of conservation and protection. Situated near the confluence of the Blackwater and Nottoway rivers, like Chub Sandhill, it contains deep, sandy soils that support a xeric pine-scrub oak plant community. Our pitfall and blacklight traps at the South Quay site were located in remnant longleaf pine barren habitat within several hundred meters of the North Carolina border. Fernald (1938, 1940, 1941) first documented the unusual flora of both areas, which includes numerous species that are at or near their northern range limits and are rare in Virginia. Recent surveys by DNH zoologists and others are beginning to document the fauna of both areas. In addition to this report, some of these results will be presented in future papers in this journal.

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Gnathobleda litigiosa, an Austral Assassin Bug New to the Virginia Fauna (Heteroptera: Reduviidae)

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ABSTRACT

The assassin bug *Gnathobleda litigiosa* Stål, a species that rarely is collected in the United States, is reported from Virginia for the first time, representing a northern range extension from southeastern Georgia and the first record of the genus in the state.

Key words: *Gnathobleda*, Reduviidae, Virginia.

One almost certain way to increase the known fauna of any given region is to publish an account of that fauna that pretends some measure of completeness. The first author's recent synopsis of the assassin bugs of Virginia (Hoffman, 2006) treated 46 species known to occur, with the qualification that as many as ten more might eventually be added. To his surprise, the newest documented member of this family in the state was not on the list of hypothetically probable species, and it was found so soon after the publication of the monograph. We herewith document the occurrence of a member of the subfamily Stenopodainae, which also adds another genus to the 27 already known in Virginia. This insect is *Gnathobleda litigiosa*, described by Carl Stål in 1862 from specimens taken in Mexico and subsequently recorded from Central America, West Indies, and southern United States. While conducting a survey of the moths of False Cape State Park in 2005, the second author accumulated large series of insects via blacklight trapping, including the following two specimens of *G. litigiosa*:

City of Virginia Beach: False Cape State Park, Wash Woods Environmental Education Center, 6-7 July 2005, S. M. Roble leg., 2 females (VMNH).

Under the name *G. tumidula* (now considered a junior synonym of *G. litigiosa*), Uhler (1876) stated that the species "Inhabits Texas, Cuba, &c.," Van Duzee (1917) listed Georgia and Texas, and Blatchley (1926) recorded it from Florida, Georgia, Texas, and Cuba. The more recent revision of *Gnathobleda* by Giacchi (1977) cited specimens (all in AMNH) of *G. litigiosa* from Texas, Louisiana, Alabama, Florida (including "Baton Rouge, Flda.," presumably in error for the locality of the same name in Louisiana), Cuba, Puerto Rico, Guatemala, and the Mexican states of Nayarit and Oaxaca, outlining a distribution around the Gulf of Mexico. Froeschner (1988) listed the same three states as Blatchley (1926), apparently overlooking Giacchi's (1977) report of records for Alabama and Louisiana. The National Museum of Natural History has a total of 26 specimens (last one collected in 1965 in Texas, all others 1941 or earlier) of *G. litigiosa* from Alabama, Arkansas, Florida, Louisiana, and Texas, plus 34 more from Cuba, Mexico (states of Oaxaca, Tabasco, and Veracruz), El Salvador, Guatemala, Costa Rica, Panama, and Argentina. The species has not been collected in North Carolina to date (R. Blinn, pers. comm.). Several Oklahoma specimens are housed in the Oklahoma State University collection (Arnold, no date).

In extending the known range of *G. litigiosa* northward by some 840 km (520 miles) (Fig. 1), the capture of specimens in southeastern Virginia adds substance to the already well-known subtropical aspect of that region. It is worthy of mention that the extensive trapping at False Cape State Park produced, besides the two specimens of *G. litigiosa,* only a dozen or so individuals of *Pnirontis modesta*, of the several other common reduviids that would be expected or known to occur there. Among the latter, *Pnirontis languida* is a notable absentee, having been collected in the park twice (May and August of 1998) by staff of the Virginia Department of Conservation and Recreation's Division of Natural Heritage. By contrast, Hoffman (2006) had no records for *P. modesta* east of the Suffolk scarp.

The key to genera of Stenopodainae in Virginia (Hoffman, 2006: 19) requires modification of the final couplet as follows to accommodate *Gnathobleda*:

5. Front and rear lobes of head about equal in length; genae projecting beyond end of tylus; ocelli inconspicuous; apex of female abdomen acutely elongated .... *Gnathobleda*

– Front lobe of head nearly twice length of rear lobe; genae not attaining apex of tylus; ocelli large, placed on conspicuous median tubercle; apex of female abdomen subtriangular 6

6. Profemora incrassate, with ventral row of spines; metatibial setae short, declivent except at distal fourth; anterior pronotal projection short, bluntly triangular .... *Oncocephalus*

– Profemora scarcely thicker than mesofemora and without ventral spines; metatibiae clothed in long setae standing perpendicular to tibial surface over entire length, about 3X as long as tibial diameter ...... *Narvesus*

Giacchi (1977) published habitus sketches of *Gnathobleda fradulenta*, which closely resembles *G. litigiosa*, and Champion (1898-1899) published drawings of both species. Photographs of the holotype of the latter species are also available on-line (Swedish Museum of Natural History, 2006). We provide here additional drawings of a Virginia specimen of *G.*

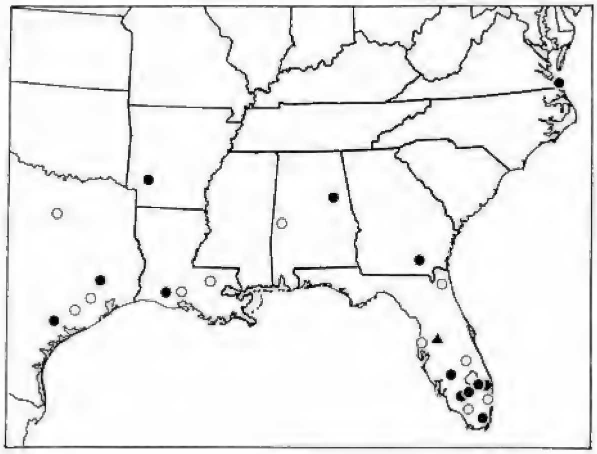

Fig. 1. United States distribution of *Gnathobleda litigiosa* based on literature records (Blatchley, 1926, 1928; Elkins, 1951; Giacchi, 1977; open circles), on-line photographs (BugGuide.net; triangle), and previously unpublished records from museum collections (closed circles).

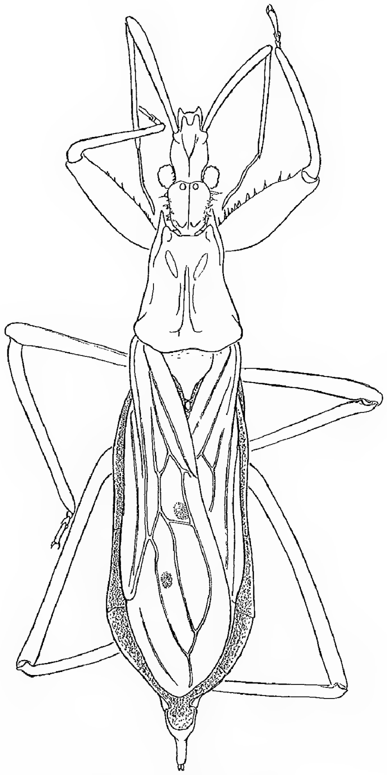

Fig. 2. Dorsal habitus of adult female *Gnathobleda litigiosa* from False Cape State Park, City of Virginia Beach, Virginia.

litigiosa as a further aid in recognition (Figs. 2 and 3).

The discovery of *Ctenotrachelus shermani* at Virginia Beach in 1989 (Hoffman, 2004), and of *Gnathobleda litigiosa* in 2005, encourages the expectation that one more stenopodaine genus, *Diaditus*, which occurs sparingly along the Gulf Coast (McPherson et al., 1978; Blinn, 2009), also may be awaiting discovery in southeastern Virginia.

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Dr. Thomas J. Henry confirmed the identification of *G. litigiosa* and permitted access to the Heteroptera collection of the National Museum of Natural History. We thank Robert Blinn (North Carolina State University), Paul Lago (University of Mississippi), Cecil Smith (University of Georgia), and Alfred Wheeler (Clemson University) for examining collections at their respective institutions for specimens of *G. litigiosa*. Blinn also provided data on a Georgia specimen that he recently identified from the University of Georgia collection.

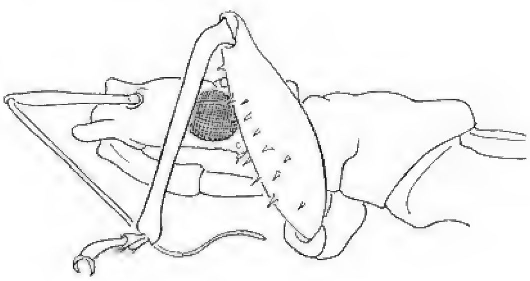

Fig. 3. Lateral view of anterior end of adult female *Gnathobleda litigiosa* from False Cape State Park, City of Virginia Beach, Virginia.

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The False Longhorn Beetles (Stenotrachelidae) of Virginia (Coleoptera)

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ABSTRACT

The family Stenotrachelidae is represented in Virginia by two species, *Cephaloon lepturides* Newman and *C. ungulare* LeConte. The latter species is recorded in Virginia for the first time.

Key words: *Cephaloon*, Coleoptera, Grayson Highlands State Park, new state record, Shenandoah National Park, saproxylic, Stenotrachelidae, Virginia.

INTRODUCTION

The Stenotrachelidae (formerly Cephaloidae) is a small family of tenebrionoid beetles with 19 species distributed throughout the Holarctic region (Lawrence & Slipinski, 2010). Of the 10 species and four genera known in North America, five species occur east of the Mississippi River (Young, 2002). In eastern North America, species in the genera *Anelpistus*, *Nematoplus*, and *Stenotrachelus* do not occur farther south than the higher elevations of the Adirondacks and are unlikely to occur in Virginia. *Cephaloon* includes six North American species, two of which occur in eastern North America (*C. lepturides* Newman and *C. ungulare* LeConte), including Virginia; two additional species are found in the eastern Palearctic (Arnett, 1953). All of the species in this genus are slender, leggy, and somewhat broad-shouldered beetles that resemble lepturine cerambycids, resulting in the common name "false longhorn beetles."

British entomologist Edward Newman (1838) described the type species, *C. lepturides*, from a single specimen collected at Trenton Falls, New York. Since its description, *Cephaloon* has been placed in the families Oedemeridae and Melandryidae by various authors. LeConte (1862) initially thought that they were meloids, but decided to place them in an entirely new family, the Cephaloidae. This family name was eventually replaced by Stenotrachelidae on the basis of priority (Silfverberg, 1990).

METHODS

This study is based on my own field work, literature records, and the examination of specimens housed in the following collections: Department of Recent Invertebrates, Virginia Museum of Natural History, Martinsville, Virginia (VMNH); Department of Entomology, National Museum of Natural History, Smithsonian Institution, Washington, DC (USNM); George Washington Memorial Parkway, Turkey Run Park, McLean, Virginia (GWMP); Shenandoah National Park, Luray, Virginia (SNPC); Bull Run Mountains Conservancy, The Plains, Virginia (BRMC); Arthur V. Evans, Richmond, Virginia (AVEC).

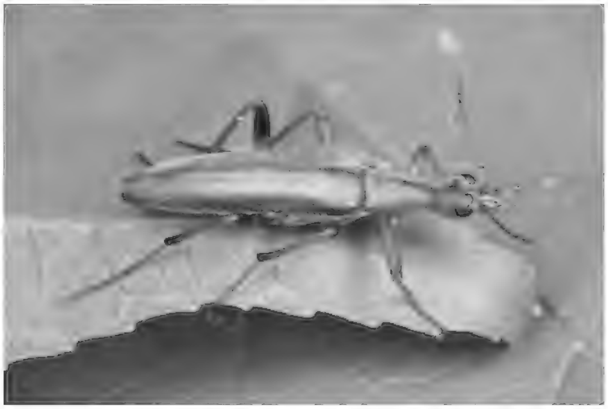


Fig. 1. *Cephaloon lepturides* Newman. Shamokin Nature Preserve, Wintergreen, Virginia. © 2009, Arthur V. Evans.

RESULTS AND DISCUSSION

Virginia species of *Cephaloon* (7.5-14.0 mm) are elongate and uniformly yellowish-brown (sometimes with elytral margins darker), brownish-black with paler appendages, or bicolorous with elytra, abdomen, metathorax brownish-black and remaining body and appendages yellowish-brown. The head, pronotum, and appendages are variably marked with diffuse brownish patches. *Cephaloon* is distinguished from all other Virginia beetle genera by having a diamond-shaped head that is narrowed gradually behind the distinctly notched eyes, a distinct neck, and prognathous mouthparts. There are 11 antennomeres. The prothorax appears bell-shaped when viewed from above and becomes narrower toward the head, has rounded sides lacking a sharp margin that separates the upper and lower surfaces, and possesses procoxal cavities that open posteriorly. The elytra are gradually narrowed toward their tips, vaguely ridged and irregularly punctate, and completely cover the abdomen. The legs are long and slender, and have a tarsal formula of 5-5-4. The tarsomeres are uniformly slender, lack pads underneath, and are tipped with pectinate claws accompanied by a membranous lobe underneath. The underside of the abdomen has five segments visible with posterior margin of fifth segment distinctly emarginate (males) or not (females).

Stentotrachelids are relatively rare in collections. The short-lived adults are seldom collected in numbers and thought to feed on pollen. They are typically found in Virginia during late spring resting on flowers or vegetation during the day in montane deciduous and coniferous forests. They are collected by hand, or by sweeping and beating vegetation. Individuals are also attracted to lights at night or captured in Malaise and flight intercept traps. The larva of *C. ungulare* is depicted in Lawrence (1991), while that of *C. lepturides* is figured in Böving & Craighead (1931) and Peterson (1951). The larvae of *C. ungulare* develop in decaying conifer logs infected with brown rot (Lawrence, 1991).

Adults of both species of *Cephaloon* are quite variable in size and color, but are reliably distinguished from one another by the characters in the key below.

Key to the Adult *Cephaloon* of Virginia

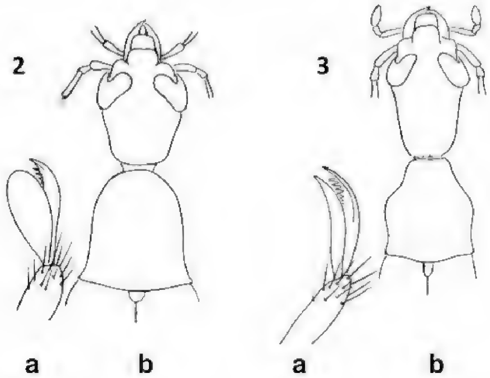
Ventral lobe of tarsal claws robust, rounded at tips (Fig. 2a); lateral margins of prothorax distinctly undulate before posterior angles (Fig. 2b); head subequal in length to pronotum (Fig. 2b); antennae reach to basal quarter of elytra, antennomeres 9-10 short and triangular, 11 obovate................................ .... *Cephaloon lepturides* Newman

Ventral lobe of tarsal claws slender, curved at tips (Fig. 3a); lateral margins of prothorax virtually straight before posterior angles (Fig. 3b); head longer than pronotum (Fig. 3b); antennae nearly reach mid point of elytra, antennomeres 9-11 filiform ....*Cephaloon ungulare* LeConte

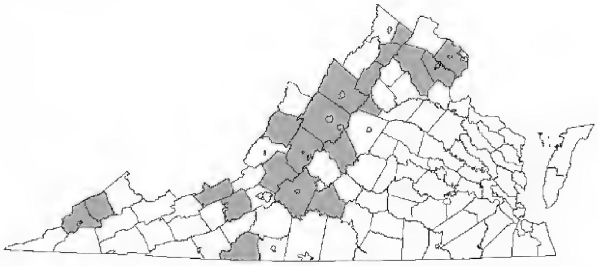
Cephaloon lepturides Newman
(Figs. 1, 2; map 1)

This species occurs in eastern North America from the Maritime Provinces to Georgia, west to Minnesota and West Virginia. **United States:** Connecticut, Georgia, Maine, Maryland, Massachusetts, Michigan, Minnesota, New Hampshire, New Jersey, New York, North Carolina, Pennsylvania, Rhode Island, Vermont, Virginia, West Virginia, and Wisconsin. **Canada:** New Brunswick, Nova Scotia, Ontario, Prince Edward Island, and Quebec. (Arnett, 1953; Majka, 2011).

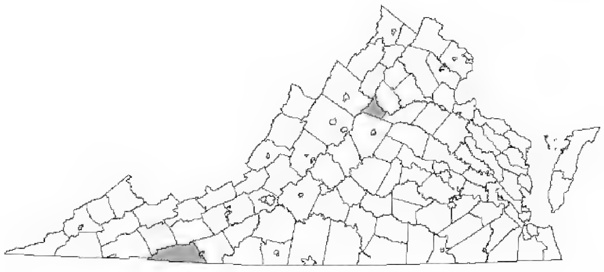
In Virginia, *C. lepturides* has been found during the months of May and June in the following counties: Augusta, Bath, Bedford, Botetourt, Campbell, Clarke, Dickenson, Fairfax, Fauquier, Giles, Greene, Montgomery, Nelson, Page, Patrick, Prince William, Rockbridge, Rockingham, Warren, and Wise. (AVEC, BRMC, SNPC, USNM, VMNH)



Figs. 2-3. 2. *Cephaloon lepturides* Newman. a. Claw with robust membranous lobe rounded at tip. b. Head and pronotum. 3. *Cephaloon ungulate* LeConte. a. Claw with narrow membranous lobe curved at tip. b. Head and pronotum.



Map 1. County distribution of *Cephaloon lepturides* Newman based on specimens examined from Virginia.



Map 2. County distribution of *Cephaloon ungulare* LeConte based on specimens examined from Virginia.

Cephaloon ungulare LeConte

(Fig. 3; map 2)

NEW STATE RECORD

This species occurs in eastern North America from Labrador and the Maritime Provinces to South Carolina, west to Ontario and Tennessee. **United States:** Maine, Maryland, New Hampshire, New York, North Carolina, Pennsylvania, South Carolina, Tennessee, Virginia, and West Virginia. **Canada:** Labrador, Newfoundland, Nova Scotia, Ontario, Prince Edward Island, and Quebec (Arnett, 1953; Majka, 2011).

Cephaloon ungulare is restricted in Virginia to the higher elevations of the Blue Ridge Mountains and is known from the following localities: **Grayson Co.:** Grayson Highlands State Park, drift fence site 1, 19 May-2 June 1991, VMNH survey (1); White Top Mtn., drift fence site off FS 89, 5000', 11-25 June 1993, beech woods, VMNH survey (1); Mt. Rogers, 15 July 1971, Turner (1). **Greene Co.:** Shenandoah National Park, Upper Devils Ditch, rock outcrop, elev. 3421', 8-9 June 2005, uv, A.C. Chazal and C.S. Hobson (1); same data, except elev. 3189' (1). (SNPC, VMNH)

Little is known about the biology of *Cephaloon*. Their montane distribution and the saproxylic preferences of the larvae suggest their possible use as biological indicator species in Virginia. Populations of saproxylic beetles are significantly related to parameters of forest structure and health (Majka & Pollock, 2006). The impacts of current forest management practices on these and other saproxylic tenebrionoid beetles (Tetratomidae, Melandryidae, Synchroidae, and Scraptiidae), especially those that reduce coarse woody debris and fragment old growth forests in the Blue Ridge Mountains and Cumberland Plateau, are poorly understood and require further study.

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Shorter Contributions

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EARLY NEST RECORD FOR WORM-EATING WARBLER (*HELMITHEROS VERMIVORUM*) IN VIRGINIA. — On 7 May 2011 the ground nest of a Worm-eating Warbler (*Helmitheros vermivorum*) was discovered in Leesylvania State Park, Prince William County, Virginia, after one of the authors (KCRK) inadvertently flushed an adult from the nest. The bird called in alarm from a nearby ground perch but did not engage in an open wing display. The nest was in typical microhabitat for this species (Bent, 1953): on a wooded slope descending to a creek. The forest floor was layered thickly with oak leaves (*Quercus* spp.). Ground cover was relatively sparse but a patch of Blue Ridge Blueberry (*Vaccinium pallidum*) mostly concealed the nest (Fig. 1A).

The nest contained six eggs of Worm-eating Warbler, plus a single egg from Brown-headed Cowbird (*Molothrus ater*) (Fig. 1B). While the clutch size is within the normal range for this species (4-6 eggs), it has been observed that final clutch size is generally smaller in parasitized nests (Hanners & Patton, 1998). Nest parasitism rates of Worm-eating Warbler evidently vary by region (Hanners & Patton, 1998; Dececco et al., 2000; Gram et al., 2003;), but the rate has been known to decrease with nesting date (S. Robinson, pers. comm. *in* Hanners & Patton, 1998).

Our observation represents an early nesting record for this species in Virginia. Like most passerines, the Worm-eating Warbler lays only a single egg per day (Hanners & Patton, 1998; McMaster et al., 1999), and was likely already incubating on the date of discovery, so the first egg must have been laid at least as early as 2 May 2011. The previous early record for the state

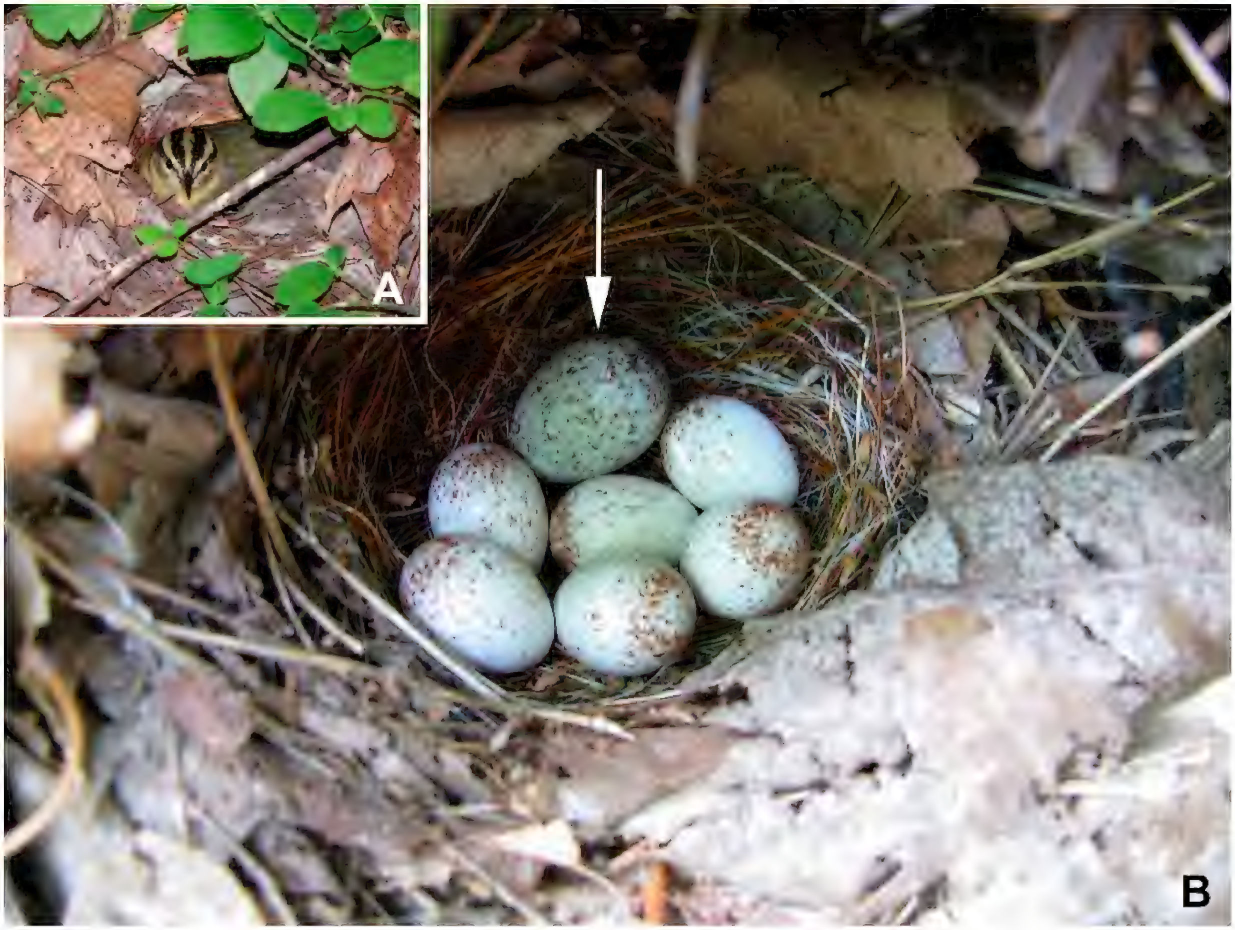

Fig. 1. (A) Worm-eating Warbler (*Helmitheros vermivorum*) sitting on a ground nest hidden by a patch of Blue Ridge Blueberry (*Vaccinium pallidum*). (B) Six eggs of the host species were present plus one egg from a Brown-headed Cowbird (*Molothrus ater*); an arrow indicates the latter.

was 11 May based on a Chalk Mountain nest containing three eggs found on 13 May 1967 (Clapp, 1997). Early egg dates for Maryland and Pennsylvania are 29 May and 15 May, respectively (Robbins & Blom, 1996). Mean temperatures in Virginia for both April and May of 2011 were above normal (National Climate Data Center, http://www.ncdc.noaa.gov/oa/climate/research/cag3/cag3.html). The effect of environmental temperature (versus genotype) on lay date remains unclear (Brommer et al., 2008), but there is evidence from other avian species that nesting dates are averaging earlier in parallel with the changing climate (see Crick, 2004, and references therein).

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We thank Jeff Foster, District Manager for Virginia State Parks, for permission to work in the park, Roger Clapp for sharing his knowledge of Virginia nesting records, and David Ziolkowski, USGS Patuxent Wildlife Research Center for information on Maryland breeding records.

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WHAT KIND OF FLEAS DOES YOUR DOG HAVE? — Only a few of the approximately 2500 known species of fleas worldwide have common names. These are usually common flea species that are parasites on humans and domestic animals. The dog flea, *Ctenocephalides canis* (Curtis, 1826), and the cat flea, *Ctenocephalides felis* (Bouché, 1835), are among these. By their names, one would expect dogs to have the dog flea and cats the cat flea. What do we actually find in Virginia? I have examined the fleas taken from 29 dogs from Virginia. In total, 244 fleas were identified and all were cat fleas! The cat fleas from dogs were obtained from the following counties in Virginia (those marked with an asterisk are new county records): Accomack*, Albemarle*, Arlington, Augusta*, Chesterfield*, Fairfax*, Fauquier*, Henrico, James City*, Loudoun*, Louisa*, Prince William*, York*, and Portsmouth City*. In the surrounding jurisdictions of West Virginia, Maryland, and the District of Columbia two dogs from each were examined and 321 additional fleas were collected. Once again all were *C. felis,* the cat flea.

What species of fleas do cats in Virginia carry? Eighteen cats yielded 208 fleas and all were cat fleas. Records were obtained from the counties of Accomack*, Chesterfield*, Culpeper*, Fairfax*, Fauquier*, Loudoun*, Prince William*, and Warren*, as well as the City of Fairfax*. So it appears that domestic cats and dogs in and around Virginia carry only cat fleas. Perhaps wild canids carry the dog flea. Small numbers of foxes and coyotes were examined but the outcome was the same. Four of seven Red Foxes (*Vulpes vulpes*) examined had a single cat flea each. Five Gray Foxes (*Urocyon cinereoargenteus*) and a single Coyote (*Canis latrans*), all from Fairfax County, had no fleas.

The dog flea is known from Virginia but the records are old. The last record of *C. canis* in Virginia was in Richmond in 1937 (Fox, 1940). In Maryland, there is a 1920 record from Takoma Park (Fox, 1940). Apparently, dog fleas were never as numerous as cat fleas, but even less so today.

Fleas of the genus *Ctenocephalides* evolved in the Old World where 13 species occur (Beaucournu & Menier, 1998). Both the cat and the dog flea now occur worldwide, having been spread with domesticated dogs and cats. In Fairfax County, Virginia, as well as elsewhere, the cat flea has colonized Virginia Opossums (*Didelphis virginiana*; seven of 30 examined were infested) and Raccoons (*Procyon lotor*; two of 23 were infested). The cat flea is the principal vector of the bacterium, *Rickettsia felis*, which causes a febrile disease in humans. Domestic cats and their fleas are probably the main sources of human infections but the wild opossums in suburban neighborhoods are reservoir hosts for the bacterium (Boostrom et al., 2002).

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Historical Contributions

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T. A. Conrad's Calfpasture River Mussels (Bivalvia: Unionoida: Unionidae)

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ABSTRACT

The circumstances leading to T. A. Conrad's visit to Virginia in 1845, which resulted in historically important freshwater mussel collections, are reviewed in the context of the occupation of his host, Constant Newkirk, in iron smelting activities near Goshen, Virginia.

Key words: T. A. Conrad, Virginia, Calfpasture River, Rockbridge County, mollusks.

Along with his contemporaries C. S. Rafinesque, Thomas Say, and Isaac Lea, Timothy A. Conrad (Fig. 1) described a substantial number of the freshwater mollusks known to occur in eastern North America, and is the only one of that coterie known to have collected them in Virginia.

Conrad (1803-1877) was born in New Jersey and spent most of his life in Philadelphia, where he was actively associated with the Academy of Natural Sciences. Although he was very literate and a competent poet, his retiring, almost reclusive personality did not inspire much biographical information in the writings of his colleagues.

During the summer of 1845, Conrad was the guest of his friend Constant W. Newkirk, proprietor of an iron furnace near Goshen, on the headwaters of the Maury River in Rockbridge County, Virginia. While there, Conrad "... paid some attention to the Naiades and univalves of the vicinity" and in the following year (1846) published a short account of his discoveries as well as his impressions of that region. Since the stream investigated by Conrad was later apparently sterilized by chemical contamination, his observations provide a glimpse of the original freshwater mussel (unionid) diversity of the upper Maury River, now lost beyond hope of recovery. His short paper is printed below in its entirety to provide both the factual information and the opportunity to enjoy Conrad's picturesque writing style.

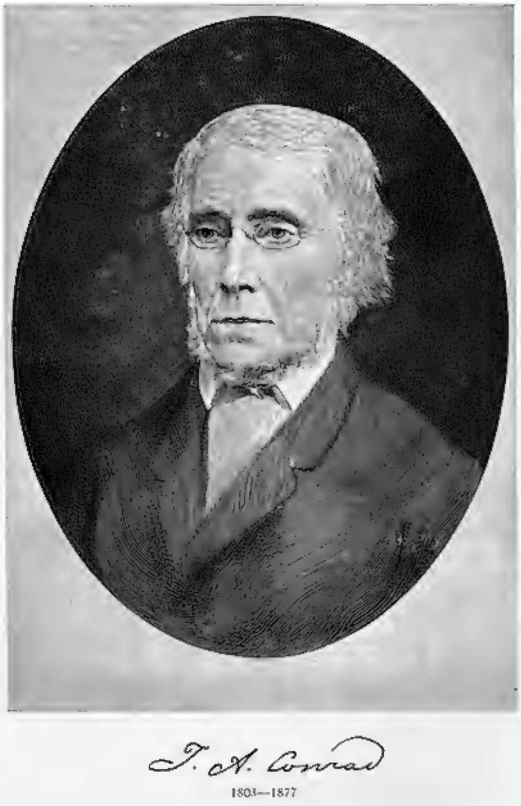

Fig. 1. Portrait of T. A. Conrad (from Wheeler, 1935).

Those familiar with the old literature on unionids may recall an earlier cameo appearance of Constant Newkirk, mentioned by Conrad (1836) as collector of the types of *Unio subplana* in the North River at Lexington, Virginia. Newkirk came from a Philadelphia (ex New Jersey) family, and presumably had met Conrad in that city prior to 1835 when he was a student at the then-Washington Academy, and was inspired to procure local bivalve specimens for him[1]. He was the nephew of Eliza Newkirk Weaver, the wife of William Weaver, a well-known owner and operator of several iron furnaces in Rockbridge County. One of these was located on Buffalo Creek, and its name persists on many modern maps as Buffalo Forge, just north of Buena Vista. Others were founded on the upper North River (there called Calfpasture), in the intermontane valley where the main stream is confluent with the Little Calfpasture. One of these, called Bath Iron Works, was under Newkirk's management from 1843 until 1847, when he gave up that (perhaps onerous) responsibility and returned to Philadelphia. So Conrad's visit in 1845 was propitious: without his discoveries there the Calfpasture would surely not have come to the attention of Conrad's distinguished successor and *facile princeps* of American unionid studies, Arnold E. Ortmann.

Some six decades after Conrad's exploration, in 1912, Ortmann collected in the Calfpasture at Conrad's locality and farther downstream in the North River near its confluence with the James[2]. Without specifying in which part of the river he found which species, Ortmann (1913) reported eight species of unionids, two of which (*Strophitus undulatus* and *Lasmigona subviridis*) were not mentioned by Conrad, but he failed to recover two others (*Alasmidonta varicosa* and *Pyganodon cataracta*) listed by Conrad. Conceding these exceptions as likely residents of the Calfpasture, Ortmann thus accounted ten unionids as native to the river, a substantial number for an upland stream in the Altlantic drainage. According to the map provided in Weaver's biography (Dew, 1994), Bath Iron Works was situated near the confluence of Guys Run, at the present Route 601 bridge. Whether Ortmann was able to localize his efforts that precisely is unknown.

Another eminent malacologist was drawn to Conrad's site. Joseph P. E. Morrison was in the river on 24 July 1937, 25 years after Ortmann's visit, and obtained specimens of *Villosa constricta* [USNM]. His label specifies "upper end of Goshen Pass" which would be about two miles downstream from the Bath Iron Works site.

On 10 July 1988, I waded the Calfpasture at a point just below the Brattons Run confluence, some two miles upstream of the Bath site. In over an hour of visual and tactile search, I could not find a single unionid, even a dead valve. Although personal surveys conducted subsequently in the river at Goshen have been consistently negative, Michael and Elizabeth Lipford found three male and one female living specimens of *Villosa constricta* (VMNH 289) further upstream: near the intersection of Routes 600 and 614, on 14 September 1989 (ca. 4 miles north of Goshen, in Rockbridge County).

Desiring a more recent impression, I returned to the Calfpasture on 13 October 2008, and waded for about an hour in a reach of the river somewhat closer to the iron works site. My findings were curiously contradictory: the stream bed looked clean and healthy, with numerous colonies of an *Elodea* (?*canadensis*) and a *Potamogeton* (?*nodosus*). Many small fish (apparently *Rhinichthys atratulus*) were seen, as well as a large gravel mound piled up earlier in the season by spawning cyprinids. Mollusks were represented by astronomical numbers of a pleurocerid snail (*Mudalia* sp.), all of which were either immature or depauperate — less than 8 mm in height. With respect to bivalves, however, this search was essentially a rerun of 1988: no trace of unionids could be found. A new element however was detected: several small, separated, worn valves of the exotic Asian clam (*Corbicula fluminea*), none more than about 10 mm long, perhaps remnants of a much earlier, unsuccessful, invasion.

A factor present in both 1988 and 2008 is a wood processing plant located at the intersection of State Route 39 with Route 780, two miles west of Goshen. The primary product appears to be railroad cross-ties, which requires infusion of the wood with creosote, an infamous agent of mass destruction. Although the diversity of aquatic organisms immediately downstream, in both years, did not reflect any recent contamination, in a less regulated earlier time, creosote leakages could easily have sterilized the Calfpasture/Maury River all the way to its confluence with the James. Recolonization from feeder stream populations rarely reconstitutes the original mussel fauna in such situations.

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[1] A compilation of the alumni and faculty during the 1800s filed in the Special Documents section of the Leyburn Library at Washington & Lee University registers a "Constance W. Newkirk" as a student in 1835-1836. Despite the slight difference in spelling, the singularity of the name itself is assurance of the identity of the individual.

[2] The nomenclature of this stream is a little ambiguous. The main stem was called the North River as far as the west portal of Goshen Pass where, at its confluence with the Little Calfpasture, the name changed arbitrarily to Calfpasture, thence to its source near Deerfield, some 30 miles to the north in Augusta County. In an attempt to humanize this already well-named stream, its name was changed from North to Maury to commemorate the oceanographer Mathew Fontaine Maury (who was said to be so fond of Goshen Pass that he requested to be driven through it, postmortem, on the way to his interment).

Files of the Goshen Public Library contain extensive historical materials relating to the former iron industry of that region. Several sources placed the Bath Iron Works on the Calfpasture about half a mile upstream of its confluence with the Little Calfpasture. One old map even indicated the exact location as being a few hundred yards west of the present State Route 39 bridge over Guys Run. I walked over the site and found no trace of any former activity. The Bath Iron Works site was abandoned and demolished in 1850, and more recently, during improvement of State Route 39 by the Virginia Department of Transportation, even the foundations were broken up and utilized in the new construction.

Although there appear to be no extant populations of unionids in the entire length of the river downstream of Goshen, a thriving, albeit very localized, community consisting of several unionid species has been found near the headwaters of Mill Creek (D. H. Stansbery and W. J. Clench, unpub. data; specimens collected 2 October 1970 are deposited in the Ohio State University collection; recent observations at same site by M. A. McGregor and B. T. Watson, pers. comm.), a major tributary confluent with the Calfpasture at Goshen, so further exploration and protection of the region is certainly desirable.

While the location of Newkirk's residence, vis-à-vis the furnace, is unknown (and could even be as distant as Goshen itself), it seems probable that a view upstream from the Route 601 bridge would show one of the very reaches of the Calfpasture investigated by Conrad. He also mentioned collecting at millponds, of which there are none presently extant in that vicinity, although tautologically one obviously must have existed on Mill Creek itself, and perhaps others were on the Little Calfpasture.

Ortmann's mussel collections are in the Carnegie Museum, and perhaps Conrad's specimens may exist in the Academy of Natural Sciences of Philadelphia, although I did not find any during a visit there in 1989.

ACKNOWLEDGEMENTS

I am indebted to the staff of the Goshen Public Library and of the Leyburn Library at Washington & Lee University for access to historical resources, to Jay Gilliam (Greensville, Virginia) for loan of Charles Dew's book on Rockbridge County iron furnaces, to Dr. Ellen Strong for help in locating material in the National Museum of Natural History collections, and to Dr. Lauck W. Ward for bringing Wheeler's biography of Conrad to my attention.

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Historical Contributions

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Art. IX. — *Notices of Fresh Water Shells*, *&c*, *of Rockbridge County*, *Virginia*; by T. A. CONRAD.

Last summer, while on a visit to my friend, Constant W. Newkirk, Esq., in Rockbridge County, Virginia, I paid some attention to the Naiades and univalves of the vicinity. The river here is called the "Calf Pasture," and is a small stream flowing through a mountain gorge. It is a branch of North river, which latter unites with James river near the Blue Mountain chain. It may not be uninteresting to conchologists to learn that the second species of Unio known to have spines is abundant in these rivers. I collected a great variety of them, and observed some peculiarities that may not be unworthy of notice. I was indebted to muskrats for all the specimens having spines, except some very young shells which I took alive; and thirty or forty occurred in one spot, in company with the very young of U. lanceolatus. No where else, after a diligent search, could I find the young of either species. On the muddy shore of the river where muskrats resort, especially about the still water of the dams, I procured many specimens of Unio collinus, with spines, which I found to vary in the number and position of these spines; some would have a rather long spine on one valve only, others a spine on each valve; others two short ones on the umbo, ranged in the direction of the shell's length; others with three spines, and some with two ranged in a line from beak to base. One specimen has a spine just below the umbo, and near the base are two thick ones in a line with the shell's length. In very rocky places where the water is rapid I found some living specimens of this species, all destitute of spines, which indeed is the condition of a great majority of the *collinus.* It is worthy of observation that this spinous character prevails most among the specimens in still water where there is a muddy bottom, and least of all where the water is most rapid. On the rocks live vast numbers of Anculosa dilatata, a very variable univalve, and this, with a few specimens of Melania virginica, Ancylus rivularis, Planorbis parvus and Paludina decisa, were the only univalves I noticed. The Unio lanceolatus is abundant, and may be found alive among the rocks and stones. Great numbers always occur, with the animals eaten out, about the muskrat haunts and holes in the banks. Unio subplanus, *Con.*, is not uncommon in similar situations, and U. constrictus, *Con.*, is still more abundant. The latter species and U. purpureus of Say, are the two species most commonly obtained alive.

It is curious to observe the partiality of the muskrat for particular haunts, as is made evident by heaps of shells, the relics of their nightly repasts. A particular rock near shore, surrounded by water, will be seen covered with shells, and on one side of the rock a deep stratum of them in the mud, while other rocks near, apparently equally well fitted for the festive board, are never furnished with a single shell. I have repeatedly visited one of their favorite rocks in a morning, and collected fine specimens which had been fished up and the animal eaten over night. But although Unio collinus was common among them, and the water was shallow, I was unable to find the living specimens whose haunts seem to be so well known to the Naiad-loving quadruped.

Between the different mountain spurs in this wild region, there are beautiful valleys with level and fertile land. The mountains are quite steep and composed of non-fossiliferous rocks of the carboniferous system, but coal does not occur. Iron ore is excellent and abundant, and within a short distance of Mr. Newkirk's furnace. The climate here is about the same as that of the latitude of Philadelphia, the elevation of the land being equivalent to the difference of latitude. But in these wooded and mountain regions the sudden fall of temperature at night, is often very great, particularly after rain, and therefore ill suited to an invalid's constitution.

The shells of Calf Pasture river are comprised in the following list: —

Bivalves.

Unio collinus, *Con.*
U. purpureus, *Say.*
U. constrictus, *Con.*
U. subplanus, *Con.*
U. lanceolatus, *Lea.*
Alasmodon undulata *Say.*
A. marginata, *Say.*
Anodon cataracta, *Say.*
A. marginata ? *Say.*

Univalves.

Planorbis parvus, *Say.*
Ancylus rivularis, *Say.*
Paludina decisa, *Say.*
Anculosa dilatata, *Con.*
Melania virginica, *Say.*

Miscellanea

Obituary

Franklin J. Tobey, Jr. (1919-2010)

Numerous amateur naturalists who have a paying job doing one thing but spend their free time devoted to a field of science have made substantial and sometimes significant contributions. One such person was Franklin J. (Frank) Tobey, Jr. He was an amateur naturalist interested in the communication of science to the public. He contributed much to herpetology, in this case to the herpetology of Virginia.

I first met Frank at a Virginia Herpetological Society (VHS) meeting at Camp Shawondasee in Chesterfield County in the fall of 1962. This was my first VHS meeting at age 14. The VHS officers made me feel welcome despite my age. Frank and the other society officers were devoted to Virginia's amphibians and reptiles and sought to keep it state-focused, despite some pressure to add exotics to society activities. Frank and the others, including my uncle Costello Craig, helped me to see that they were doing science by adding knowledge to our understanding of this group of animals. I credit Frank, Cos, and the VHS at that time for planting the seed that later caused me to become a professional scientist. I also credit these persons for making sure that including young people has always been a large part of how the VHS operates.

The VHS originated in the mind of Frank Tobey. As a high school student in New Jersey, Frank helped amass distribution records for the snakes of that state (Trapido, 1937). With that background, he saw the need for such herpetological information when he came to Virginia. In 1957, he wrote an article on snakes for *Virginia Wildlife* (Tobey, 1957) and asked if there were people who might be interested in forming a group. He and the original officers determined that their first focus would be on gathering locality information to generate distribution maps. Frank found like-minded friends, particularly W.L. Witt, another amateur, and started to accumulate reliable information on the distribution of amphibians and reptiles in the Commonwealth. The only checklist of species with locality information (e.g., counties) available on this topic was E.R. Dunn's (1936) checklist with county notations. These first VHS officers also consulted scientific papers written by others such as R.L. Hoffman (e.g., Hoffman 1944, 1945a, b, 1953), to obtain geographic location information. Frank was the repository of the society's distribution records derived from the Smithsonian Institution's Division of Amphibians and Reptiles, other museums, the literature, and viable reports from citizens. His goal was to produce, through the VHS, a book with detailed distribution maps for all of Virginia's native species. It was to be a long-term project that finally came to fruition in 1985 (Tobey, 1985). Frank Tobey was a prominent figure in the VHS during its first 21 years of existence, and during lean times he WAS the VHS.

Frank and the co-founders of the VHS (W.L. Burger, O.K. Goodwin, R.H. deRageot, W.L. Witt, J.T. Wood) met at Camp Shawondasee on 18 October 1958 to officially inaugurate the society. Frank, having been a reporter and associate editor of a Washington, D.C. magazine, became the Secretary and newsletter editor. He wrote, printed, and distributed a total of 90 issues of the *VHS Bulletin* between 1958 and 1979, sometimes mailing as many as 300 copies of each issue. Although there were articles written by members, much of the information he wrote himself based on correspondence and notes from members. The journal *Catesbeiana* took the place of the *VHS Bulletin* a year after the last bulletin appeared (1979). Frank also organized many of the early VHS meetings, including those at the National Zoo in Washington.

Franklin Joseph Tobey, Jr. was born on 22 February 1919. He grew up in Newark, New Jersey, where he was a member of the Newark Museum's Natural Science Club from 1933 to 1938, when he graduated from high school. He was an Eagle Scout and assisted the camp doctor at BSA Camp Mohican for many years. He enrolled in Seton Hall University in Newark but transferred to Columbia College in New York, graduating in 1942 as a dual zoology and political science major. He was inducted into the U.S. Army on 10 June 1942 where he was trained at Camp (now Fort) Pickett, Virginia, as a motor transport officer in the Medical Corps. He was commissioned a Lieutenant after additional training at the Army Medical Field Service School in Carlisle, Pennsylvania, in 1943. He served in Ardennes, the Rhineland, and central Germany during World War II. He assisted in the return home of Allied Forces who had been in German Prisoner of War Camps. Soon after returning to the United States in early 1946, he married Carolyn Wiederspahn in June of that year. He graduated with a Master of Arts in Economics from Columbia College in 1947 and a year later settled in Oakton, Fairfax County, Virginia. He also lived in Maryland for a few years while still running the VHS before his move to a stone house on a ridge near Purcellville in Loudoun County. They had two daughters, Carolyn Tobey Berardesco and Alix Tobey Southwick, and one son, Franklin Joseph Tobey III. Joe played bagpipes at dawn at some

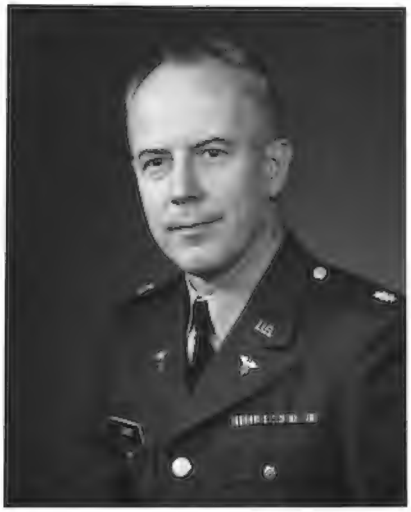

Fig. 1. Franklin J. Tobey, Jr. as a U.S. Army reservist in 1969. Photo provided to J.C. Mitchell by Frank Tobey.

of the field-oriented meetings in the early 1960s, sometimes to the ire of some participants. Frank had six grandchildren and six great grandchildren. Until 1959, Frank was a reporter and editor for the *Public Utilities Fortnightly* magazine but that year he was invited to join the U.S. Atomic Energy Commission as a media consultant and liaison with the U.S. Public Health Service. He remained in the U.S. Army Reserve until he retired as a Lieutenant Colonel in February 1969 (Fig. 1). Frank was always proud of his years in Europe and especially Germany. He knew German well and always signed himself "Franz Josef" in letters to Richard Hoffman.

Frank continued to produce the *VHS Bulletin* for ten years after retiring. In reviewing specimen lists for the distribution maps (Tobey, 1985), he discovered that a Six-lined Racerunner (*Aspidoscelis sexlineata*) housed in the Museum of Comparative Zoology, Harvard University, had been collected in the Civil War during the Seven Days Battle in Hanover County in 1862. He tracked down the collector’s name, which turned out to be Union General George G. Meade, or one of his staff. The specimen was sent to secure the attention of a Harvard scientist who Meade wanted on his staff. Frank’s interests in history and herpetology combined to produce his article in the *Civil War Times Illustrated* (Tobey, 1991) that described this historical connection. Frank also contributed to the first effort to evaluate all of Virginia’s threatened and endangered plants and animals by editing and writing some of the species accounts on amphibians and reptiles for the first book on the topic (Linzey, 1979; Tobey, 1979).

Upon retirement, Frank’s long-time interest in geology and minerals led him to become active in amateur geology clubs (Franklin-Ogdensburg Mineralogical Society and the Mineral Club of Lower Bucks County, NJ) where he contributed articles to their newsletter. He wrote his memoirs of his experiences in World War II. He still contributed articles for *Catesbeiana*, however (Tobey, 1988, 1989a, b, 2008). In 1998, the VHS awarded Frank Tobey with its first Lifetime Achievement Award during the society’s 40th anniversary meeting in honor of his outstanding contributions to Virginia herpetology and the VHS. This award was established to recognize members who have made important contributions to Virginia's herpetofauna and exhibited a positive image that reflects the values of the VHS.

Frank Tobey (d. 6 May 2010) will be remembered primarily as the person who almost single-handedly kept the VHS alive for over 20 years. Many VHS members who knew him will remember his kindness and gentle prodding to gather distributional data. His dedication to Virginia herpetology as an amateur naturalist is unmatched. He influenced numerous young people through the Bulletin, correspondence, and interactions at VHS meetings, including me. Virginia herpetology will forever be grateful to this amateur naturalist from New Jersey. His dedication to science shows what can be done by amateur naturalists if one stays focused. Such a life dedicated to a worthy cause would well be emulated by others seeking to make a difference.

I remember Frank for his warm and enthusiastic support of all the members who showed up for the meetings, except for the very few who were noisy and distracting. Even then he was the consummate diplomat, although he would tell some of us in private what he really thought. He was, after all, a military officer and acted much in that dignified manner. He was dedicated to the survey and followed up on each and every specimen location he knew about, and in those days it was all by letter. He told me that everything he learned about Virginia herpetology back then he put into the *VHS Bulletin*. Being a reporter, he of course put this material in more of a news format than a scientific format. I became less than enthusiastic about this approach around 1980 and when Frank said that number 90 of the Bulletin was his last, I advocated that the VHS start a new journal in a more scientific style. Richard Hoffman suggested the name *Catesbeiana*. Frank was not exactly pleased to see this turn of events but, nevertheless, as always, he remained a cordial and supportive friend and colleague. He could see that the VHS needed to grow in another direction

Fig. 2. Frank Tobey showing the page proofs of the Virginia herpetological distribution maps at a VHS meeting at the University of Richmond in 1982. Photo by J.C. Mitchell.

and he graciously stepped aside to let us younger upstarts take over.

The set of distribution maps (Fig. 2; Tobey, 1985) is a monument to his tenacity and love of Virginia herpetology. The meticulous records he kept on each specimen location are now protected for posterity in the VHS archives. Perusal of these documents shows that Frank was as honest and professional as any professional scientist. Virginia herpetology owes a great debt of gratitude to Frank for creating the first set of distribution maps for these two groups of vertebrates. Everything we have done and will do relative to the distributional biology of Virginia's amphibians and reptiles is and will be built on Frank's shoulders.

Acknowledgments

I thank Steve Roble and Susan Walls for critiquing earlier drafts of this obituary. Richard Hoffman provided the line about Frank's love of Germany. Janet Roetken of the Virginia Museum of Natural History sent me a copy of a letter sent to Hoffman by Alix T. Southwick following Frank's passing. I thank Frank Tobey personally for his support of my long-term interests in Virginia herpetology and for his support of me personally.

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Reports

1. President's Report

This is my first report to you as your President. We thank Barry Knisley for his just-completed two year service as President. During his tenure the Virginia Natural History Society has remained solvent and our journal, *Banisteria*, has continued to be a first rate regional journal. Membership has declined slightly but that is typical of most scientific societies. One of my goals for the next biennium is to try to increase membership. Does your library receive *Banisteria*? Check on it or see the short list of institutions that do subscribe which was presented by Barry Knisley on page 51 of *Banisteria* 36. If yours is not on the list, suggest to your accessions librarian that *Banisteria* is a worthwhile, germane, and inexpensive ($40) journal for any Virginia library to have. Each of us can try to recruit one new student or regular member this year. Emphasize that *Banisteria* is a great outlet for publication of research about Virginia and her biota. Our editor, Steve Roble, works with authors to help them get their work published. Members pay no page charges to publish.

We welcome new officers Todd Fredericksen from Ferrum College as Vice President for a two-year term and Richard Groover from J. Sargeant Reynolds Community College for a four-year term as Councilor.

Respectfully submitted,
Ralph P. Eckerlin, President

2. Secretary-Treasurer's Report

As of July 19, 2011, the society has 110 members, a gain of five since December and 18 more than we had last June. Increased efforts to encourage all of last year's members to renew for this year were very successful. Our current bank balance is $8,868.52, about $1,000 more than one year ago.

We received 40 ballots with return votes for Todd Fredericksen for Vice President and Richard Groover for Councilor.

Respectfully submitted,
William A. Shear, Secretary/Treasurer

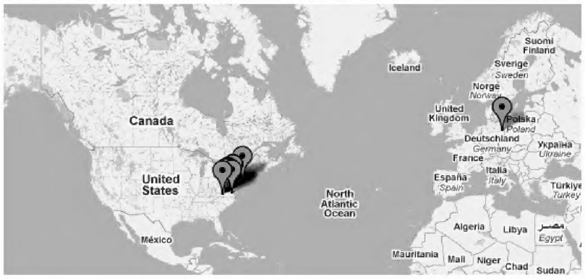
3. Webmaster's Report

VNHS website traffic during the past six months is summarized in the following table:

Month	**Page Loads**	**Unique Visitors**	**First Time Visitors**	**Returning Visitors**
Jan 2011	308	289	35	254
Feb 2011	255	231	21	210
Mar 2011	270	257	15	242
Apr 2011	266	252	26	226
May 2011	225	221	9	212
Jun 2011	199	188	13	175

DEFINITIONS:
Page Loads - The number of times the VNHS front page was visited.
Unique Visitors - Total number of visitors (first time plus returning).
First Time Visitors - First time visitor to the VNHS website.
Returning Visitors - A person returning to our website for another visit an hour or more later.

Locations of recent VNHS website visitors:



We would like to thank the Conservation Management Institute (cmiweb.org) for hosting the VNHS website.

Respectfully submitted,
John White, VNHS Webmaster

4. Editor's Report

For various reasons, this issue of *Banisteria* is much later than normal for the first one of the year. I have received at least ten submissions for possible inclusion in the next issue and will strive to get it printed by the end of the year. Finally, I would like to thank associate editor Al Wheeler for soliciting peer reviews of the two papers in this issue that I coauthored with Richard Hoffman.

Respectfully submitted,
Steve Roble, Editor, *Banisteria*

Virginia Natural History Society
Website: va-nhs.org

General Information

The Virginia Natural History Society (VNHS) was formed in 1992 to bring together persons interested in the natural history of the Commonwealth of Virginia. The VNHS defines natural history in a broad sense, from the study of plants, animals, and other organisms to the geology and ecology of the state, to the natural history of the native people who inhabit it. The goals of the VNHS are to promote research on the natural history of Virginia, educate the citizens of the Commonwealth on natural history topics, and to encourage the conservation of natural resources. Dissemination of natural history information occurs through publication of the journal *Banisteria*, named for John Banister (1650-1692) who was the first university-trained naturalist to work in Virginia. The first issue was published in 1992, and the journal is published twice per year in spring and fall. Articles cover a wide array of subjects, and prospective authors are encouraged to submit manuscripts on any aspect of natural history in Virginia; book reviews and biographies of relevance to natural history in Virginia are also welcomed. The editor of *Banisteria* will also consider manuscripts on any aspect of natural history from neighboring states if the information concerns a species native to Virginia or the topic is directly related to regional archaeology, anthropology, botany, ecology, zoology, paleontology, geology, geography, or climatology. Manuscripts are peer-reviewed for suitability and edited for inclusion in the journal. Page charges ($15/page) are waived for VNHS members. The society's website contains instructions for authors, the titles (and abstracts beginning in 2004) of all *Banisteria* papers, and downloadable versions (PDF format) of numerous articles from past years.

Memberships

The VNHS is open to anyone with an interest in natural history and welcomes participation by all members in society activities and efforts to promote education and conservation. Membership includes a subscription to *Banisteria* and invitations to periodic symposia and BioBlitz surveys. Annual dues for members are $20 (per calendar year); library subscriptions are $40 per year. Checks should be sent to the Secretary/Treasurer, who also has back issues of *Banisteria* available at $10.00 each (except Nos. 1-6 are $5.00 and No. 13 is $18.00). The VNHS is a tax-exempt, nonprofit, society under Section 501(C)3 of the IRS. We welcome donations to support our mission in Virginia.

The Virginia Natural History Society Application for Membership

Name ________________________________

Address______________________________

____

____

Zip Code ____________________________

Phone _______________________________

Email _______________________________

Area(s) of Interest _____________________

ANNUAL DUES AND SUBSCRIPTIONS TO *BANISTERIA*

(memberships and subscriptions are by calendar year; subscribers/members outside the United States should add $3.00 for additional postage)

☐ $500.00 Life (not annual)
☐ $300.00 Benefactor
☐ $100.00 Patron
☐ $50.00 Supporting
☐ $40.00 Institutional
☐ $25.00 Family
☐ $20.00 Regular
☐ $5.00 Student (see below)

☐ I have added a contribution of $______ to my membership dues.

The special student rate is applicable only when accompanied by the following certification signed by a faculty advisor.

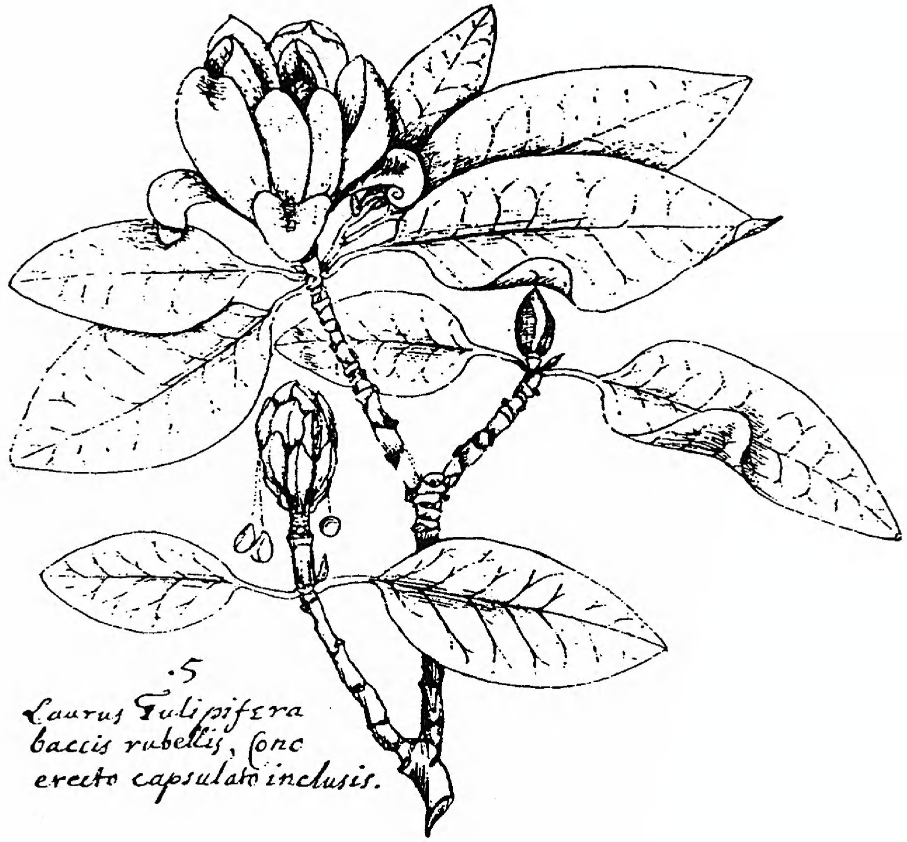
Institution __________________________

Advisor ____________________________

Date_______________________________

Make checks or money orders payable to:
Virginia Natural History Society

Send membership form and dues to:
Dr. William Shear, Secretary-Treasurer
Virginia Natural History Society
Box 96
Hampden-Sydney, Virginia 23943



Magnolia virginiana Linnaeus

Original drawing by John Banister, sent to Bishop D. H. Compton in 1689. Figure 90 in folio in Sir Hans Sloane's MS 4002 in the British Museum of Natural History. Photocopy courtesy of Joseph and Nesta Ewan.

Virginia Natural History Society